Do Teacher Age, Experience, Self-Efficacy, and Professional Development Affect Technology Implementation?

A Dissertation Presented To
The Faculty of the Education Department of
Carson-Newman University

Lori Ann Stiner Tucker

December 12, 2017
Dissertation Approval

Lori Stiner Tucker

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This dissertation has been approved and accepted by the faculty of the Education Department, Carson-Newman University, in partial fulfillment of the requirements for the degree, Doctor of Education.

Dissertation Committee

Chair/Methodologist

Dr. P. Mark Taylor

Content Member

Dr. Ronda Blevins

Content Member

Dr. Courtney Whitehead

Date Approved by Committee: 12/12/2017
Abstract

Do Teacher Age, Experience, Self-Efficacy, and Professional Development Affect Technology Implementation

Lori Ann Stiner Tucker
School of Education, Carson-Newman University
December 12, 2017

The rationale of this quantitative study was to identify the amalgamation of factors that relate to the introduction and use of new technologies in the classroom. Specifically, the age of the teacher, years of teaching experience, quality of professional development, and teacher self-efficacy as defined by Bandura (1997) were analyzed to assess the way these factors were associated with implementing new technologies in the classroom. Participants in this study were in 2 different school districts in East Tennessee. All data were collected through an online survey distributed to K-12 teachers via email. The analysis of data was based on the responses of teachers from two school districts. Research revealed that teacher age, years of teaching experience, teacher gender, and the hours spent by teachers in technology professional development did play a significant role in the self-efficacy of teachers. Findings also indicated that teacher age, years of teaching experience, teacher gender, and self-efficacy had an impact on the use of technology in the classroom. Results also indicated a relationship between the hours spent in technology development and technology use by teachers in the classroom. There was also no evidence found to support a gender difference in the self-efficacy of teachers.
Dedication

This dissertation is dedicated to my family whose steadfast love and support have been my bedrock throughout my graduate studies. I want to thank my husband, Beau Tucker, for his patience, love, and perspective. I also want to thank my parents, Ed and Susan Stiner, for their help and encouragement, my sister, Wendi Stiner, for all her assistance, and my grandmother, Helen Stiner, who told me I could accomplish anything. Her dedication to the teaching profession and love of educating children regardless of ability, race, gender, or ethnicity were truly inspirational. So many of her former students have told me stories of how she inspired them to become avid readers, of how she made sure they had something to eat at lunch, and of how she provided coats and shoes to children who had none. She remembered every name, every face, and every child who passed through her fourth-grade classroom because to her, they were each unique and special. She became a teacher when only a two-year certificate was required to teach and yet, she insisted on obtaining a B.A. in elementary education from Carson-Newman College. Hers is a legacy of love, learning, and joy; she was a true blessing to her students and to me.
Acknowledgement

I am grateful to my dissertation committee who have shared their time and professional expertise with me during this process. I would especially like to thank Dr. Mark Taylor, my committee chairman. As a professor and mentor, he has been an invaluable resource and has shown by example, excellence in teaching.
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Chapter 1

Introduction

The growth of technology has been well-documented. Smart phones, smart watches, and tablets have decreased in cost while these devices have increased in computing power. These devices have revolutionized how people communicate. Students sitting in the classrooms of today must be ready to access and use the technology of tomorrow in the workplace. According to the Bureau of Labor Statistics, “employment of computer and information technology is projected to grow 12 percent between 2014 and 2024, faster than the average for all occupations.” (U.S. Department of Labor, 2015). Thus, this proliferation of technology has changed the national conversation regarding using technology in the classroom from whether it should be used at all to how it can be used effectively.

Research suggests technology is currently not being utilized effectively in classrooms and many school systems do not have access to or are not using technology daily to improve student learning (National Educational Technology Plan, 2016). A study by Nagel (2013) also suggests one of the main problems with the successful integration of technology in the classroom is an unwillingness to do so on the part of the teacher.

Statement of the Problem

The purpose of the original study was to identify the specific combination of factors that affect, or even prevent, the implementation in the classroom of new technology. Specifically, this original study was an analysis of the age of the teacher, years of teaching experience, quantity of professional development, and teacher self-efficacy as defined by Bandura (1997).
This study will examine the ways in which these factors correlate to the implementation of new technology in the classroom and attempt to replicate the results of the original study.

Research Questions

1. Is there a significant correlation between teacher age and teacher self-efficacy scores?
2. Is there a significant correlation between years of teaching experience and teacher self-efficacy scores?
3. Is there a significant correlation between the hours spent in technology professional development and teacher self-efficacy scores?
4. Is there a significant correlation between teacher age and technology use in the classroom?
5. Is there a significant correlation between years of teaching experience and technology use in the classroom?
6. Is there a significant correlation between the hours spent in technology professional development and technology use in the classroom?
7. Is there a significant correlation between teacher self-efficacy scores and technology use in the classroom?
8. Is there a significant difference between the teacher self-efficacy scores of males and females?
9. Is there a significant difference between the classroom technology use of females and males?
Significance of the Study

The original study was an analysis of a variety of factors that reportedly affect the effective implementation of technology into the classroom. According to Makel & Plucker (2014), direct replications by third parties are lacking in educational research. Further they maintain such research will help shape policies in education. The purpose of this study is to determine whether specific factors affect technology implementation in the classroom – i.e. teacher age, years of experience, quantity of professional development, and teacher self-efficacy. While the factors in this study have been examined individually in other studies, this study examined their effect together. This study is an analysis of a combination of factors regarding technology integration, including teacher age, teacher self-efficacy, years of experience teaching in the classroom, and professional development available for teachers on implementing new technology. It is hoped this study will give much-needed insight into the factors that are preventing the effective integration of technology in the classroom. The data from this study could aid school administrators, technology supervisors, and other school leaders in identifying specific areas interfering with the integration of technology and where professional development is failing teachers.

Chapter 2

Review of Literature

This study looked at factors that influence the implementation of technology in the classroom. It specifically looked at the effect of the age of the teacher, the years of experience of the teacher, teacher self-efficacy, and the quantity of technology professional development. These factors were analyzed to determine their effect on the implementation of technology in the classroom. The majority of the research has looked at the effect of one, or at most two, of these
factors on the implementation or introduction of technology in the classroom. A review of literature, arranged according to the factors considered in the study, is necessary to gain perspective of the study.

Technology Use in the Classroom

Accountability for student educational achievement has sent many school systems scrambling to help students achieve the high academic standards demanded by high stakes testing. Each year every education policymaker from state legislators to the local school board members must make tough choices on how to allocate education dollars to improve student outcomes. Many have chosen technology as their saving grace but is technology truly the answer?

Several studies have focused on barriers to implementing technology into the classroom. Schacter (1999) conducted a study which suggested technology was not as effective when the focus of technology use was diffuse. Kuyatt, Holland, and Jones (2015) found teachers who implemented technology in their classroom had lower student achievement scores than teachers who did not. Liu et al. (2017) found access to technology in classrooms were related to technology integration. In their study, teachers without ready access to technology tended not to use it in their lessons or daily instruction. McKinley (2014) found the largest barrier to technology implementation in the classroom was the attitude of the teacher toward such usage. However, Williams, Warner, Flowers, and Croom (2014) found the biggest barrier to technology implementation in the classroom wasn’t teacher attitude or knowledge but rather the expense of the technology. Wright and Wilson (2006) found that although the skills necessary to use technology in the classroom were readily acquired, the perceived challenges of such use
remained a barrier to implementation. Rehmat and Bailey (2014) found that despite the increased availability of technology, few teachers were actually integrating it into their classrooms due to a lack of content knowledge. King (2012) suggested technology that ran counter to a teacher’s educational philosophy should not be used as its use hindered effective technology integration. Groff and Mouza (2008) found that identifying barriers to technology integration up front can empower teachers to seek solutions early and increase the likelihood of successful technology integration. Moore-Hart (2008) found teachers were more successful integrating technology when they were in a supportive, collaborative environment.

Laskin and Aveena (2015) discovered an interesting paradox in the student use of technology. While students readily embraced and used the educational side of mobile technology outside of the classroom, they rarely used mobile technology in the classroom nor did they expect to do so.

Age of the Teacher

The availability of technology and the many advances in that field are changing the ways in which information and knowledge can be delivered to students. While research results that teacher age plays a significant role in technology implementation in the classroom are mixed, the preponderance of evidence suggested it is not a factor in technology integration.

According to Oriji and Amadi (2016), most teachers were steadfast in their belief that the traditional classroom was best. Jones (2013) asserted veteran teachers were less likely than their younger colleagues to successfully utilize technology in the classroom.

Pegler, Kolleywyn, and Crichton (2010) studied both the personal and professional technology use by teachers of varying age groups. They found no difference in the amount of time spent by teachers of different age groups on purely professional technology use that had no
out of school purpose. Additionally, they found equal frustration and success rates in using technology in a professional capacity among teachers of varying ages.

In contrast, McKinley (2014) studied the relationship between faculty demographics and technology integration. He concluded age did not have any effect on technology integration. He asserted there was no significant effect attributable to age in technology implementation. Similarly, Mahdi & Al-Dera (2013) found no significant difference, ascribable to age, in using information and communication technology. Efe, Efe, and Yücel (2016) concluded preservice science teachers had high levels of self-efficacy and positive attitudes toward technology implementation regardless of age, gender, or country of origin.

Van der Kaay and Young (2012), in their study of technology use among community college faculty, also concluded faculty aged 55 or older were no less likely to plan to use technology than younger faculty on the staff. The study did, however, find faculty 55 and older did report using technology slightly less than their younger counterparts. Further the perceived technological skill levels of those faculty members 55 or older were also found to be similar to those of younger faculty members.

Teacher Experience

Research on the role experience plays in effective teaching and technology integration has produced mixed results. Tsai (2015) concluded the experienced teacher displayed an optimistic attitude regarding utilizing technology but focused mainly on pedagogy and curriculum content during implementation. In this same study, Tsai also found poor technology management was a key factor in the reduction of technology usage by experienced teachers. Wolters and Daugherty (2007) found a significant link between teacher experience and their
usage of various techniques and strategies that benefitted students of various ability levels. In 2015, Robitaille and Maldonado found teachers with greater experience exhibited exemplary questioning and discussion techniques in the classroom. Sinelnikov et al., (2016) found teachers with greater content knowledge, as seen in experienced teachers, produced better student learning. Ritzhaupt, Dawson, and Cavanaugh (2012) research results indicated a teacher’s experience teaching with technology and level of education had a significant impact on classroom technology integration and the student use of technology. In another view of experience, Howard and Gigliotti (2016) found a positive and significant correlation between a teacher’s experience with risk-taking and successful technology implementation in the classroom. Teachers in the study gained experience with specific coping strategies that supported the integration of technology in the classroom. Gilakjani (2013) found experience had a significant influence on implementing computer technology into the classroom. He found teachers with less experience (i.e. new teachers) failed to incorporate computer technology into their classroom instruction for two reasons: they were trying to learn how to use the technology and they faced other challenges such as learning the curriculum and classroom management.

Bielefeldt (2012) found teachers with at least one year’s experience using whiteboards in classroom instruction were more likely to turn operation of the devices over to students and then facilitate group use of the resources.

By contrast, Sandoval-Hernandez, Jaschinski, Fraser, & Ikoma (2015), stated there was not a universal correlation between teacher experience and student success. In some instances, students with experienced teachers showed higher achievement than students of novice teachers. Other instances showed the opposite was true: i.e. students of novice teachers showed higher achievement than those students who were in a classroom with experienced teachers. Research
Factors Affecting Technology Implementation

conducted by Letwinsky (2012) also did not find a significant correlation between teacher experience and the classroom use of technology in cultivating mathematics literacy.

Teacher Self-Efficacy

Self-efficacy has been shown to be an important component in predicting the behavior of an individual (Bandura, 1977). Research supports the idea that students benefit by being in the classrooms of teachers with high levels of self-efficacy. Liu et al. (2017) found teacher confidence and comfort of use with technology significantly influenced the integration of technology in the classroom. Research by Abbitt (2011) showed a relationship between knowledge, self-efficacy beliefs, and their influence on technology implementation. Research by Brown (2012) found staff perceived themselves to be technologically proficient and reported the biggest barrier to technology implementation was equipment failure and malfunction. Li, Li, and Franklin (2016) found technology self-efficacy, attitudes toward technology, and perceived ease of use were predictive at a significant level of potential adoption of technology into the classroom. Letwinsky (2012) found a significant relationship between a teacher’s personal self-efficacy and that teacher’s attitude toward using technology but rejected the relationship between self-efficacy and actual technology use in the classroom. Machado and Chung (2015) concluded principals should provide teachers with the kind of support that fosters confidence and efficacy for optimal technology integration.

Willis, Weiser, and Smith (2016) research suggested training which was experience-based had a significant impact on teacher self-efficacy and a sense of technological preparedness. In looking at differences between urban and rural teachers, Almeida, Jameson, Riesen, and McDonnell (2016) found differences between the two groups regarding self-efficacy.
In a study by Gilakjani (2013), self-efficacy proved to be a great influence in computer technology and learning. Teachers with greater computer self-efficacy beliefs used computers more than those with lesser computer self-efficacy beliefs.

People who rated themselves as very self-efficacious put more effort and persistence into a task. These individuals exhibited quicker recovery and goal commitment when complications and stumbling blocks occur (Bandura, 1986).

High levels of teacher self-efficacy have also been shown to influence successful classroom instruction and improved student achievement. Swan, Cano, and Wolf (2011) found highly efficacious teachers created dynamic, student-centered classrooms. Teachers with low self-efficacy were not only scornful of their own abilities, but also those of their colleagues and students (Siebert, 2006). According to Bandura (1997):

“Teachers’ perceived efficacy rests on much more than the ability to transmit subject matter. Their effectiveness is also partly determined by their efficacy in maintaining an orderly classroom conducive to learning, enlisting resources and parental involvement in children’s academic activities, and counteracting social influences that subvert students’ commitments to academic pursuits.” (p. 243)

Self-efficacy has also been shown to be a critical component to learning. Shi (2016) concluded high self-efficacy meant better student outcomes. Specifically, the study showed increased levels of academic success, lower anxiety, and a variety of academic strategies were enjoyed by learners with higher self-efficacy.

Professional Development

Increasingly professional development has become the focal point of improving student achievement. One of the guiding principles of the U.S. Department of Education policy brief on advancing technology in the classroom (2016) is for institutions to construct sustainable,
program-wide professional learning systems to enable transformative learning and teaching. In education, professional development is utilized to enhance teaching skills and is critical in improving learning outcomes for students (Bouffard & Little, 2004). Professional development can occur at any time but is most effective if it occurs when teachers can directly identify student learning gaps and apply solutions developed during professional development. It creates a culture of learning throughout the school and validates to students that learning is valuable and worthwhile (Mizell, 2010). Research appears to support the importance of technology professional development to the successful integration of technology into the classroom.

Tsai (2015) found senior teachers benefitted more from professional development in implementing technology since they often did not have the abundance of technology skills their younger counterparts possessed.

Liu et al. (2017) found the availability of quality professional development significantly affected the integration of technology in the classroom. Technology implementation was less successful when appropriate professional development was lacking.

Leary et al. (2016) found when teachers were involved in the design process for technology training and implementation, they adapted better to the barriers intrinsic to the process and achieved greater success.

A study by Miktuk (2012) showed the amount and type of professional development significantly impacted the level of technology integration in the classroom. Gilakjani (2013) concurred, finding the lack of effective training and support for teachers significantly hindered the use of computer technology in the classroom.
Professional development has also been shown to affect teacher self-efficacy. McKim and Velez (2017) found professional development was a positive predictor of teacher self-efficacy in both science and math.

Research findings appear to favor the importance of professional development to the success of technology implementation in the classroom. Further it seems to support the idea that local, familiar professional development is the most effective. Research by Ruggiero and Mong (2015) indicated technology training that was contextualized and based in teachers’ own classrooms was the most effective.

Jones and Vincent (2010) research also showed teachers responded better to a learning environment that was peer-based and familiar.

Research conducted by Davidson, Richardson, and Jones (2014) showed a local, campus-based professional development project optimized the effective use of technology in the classroom.

Nolen (2014) concluded Professional Learning Communities and strategic planning at the district level significantly aided in the implementation of large-scale technology implementation initiatives.

Montreux et al. (2015) suggested teachers fell into two categories – innovative teachers and instrumental teachers. Innovative teachers changed their teaching style to take full advantage of technology while instrumental teachers tended to view technology as merely a textbook behind glass. The results of their study indicated technology should be introduced with pedagogical support to enable both teachers and students to reach a full understanding of the potential of technology use in the classroom.
In contrast to the above studies, Parker et al. (2015) found no significant difference between teachers with extensive training versus those without on STEM workplace technologies. They called, however, for further research on effective teacher education and its impact on successful technology implementation.

Chapter 3
Research Methodology

Introduction

The purpose of this study is to replicate an earlier study that identified the combination of factors that pertained to the implementation of new technologies in the classroom. Specifically, this research originally analyzed the age of the teacher, years of teaching experience, quantity of professional development in classroom technologies, and teacher self-efficacy as defined by Bandura (1997) to examine the manner in which these factors all related to implementing new technologies in the classroom. This chapter describes the research questions and null hypothesis, research design, population, instrumentation, data collection, and analysis of the data that will be used in replicating the original study. This study uses non-experimental, quantitative research with a comparative and correlational design.

Research Questions and Null Hypotheses

The following questions and their corresponding null hypotheses relating to teachers’ age, years of experience, professional development, and self-efficacy will be addressed:

1. Is there a significant correlation between teacher age and teacher self-efficacy scores?
Ho1. There is no significant correlation between teacher age and teacher self-efficacy scores.

2. Is there a significant correlation between years of teaching experience and teacher self-efficacy scores?

Ho2. There is no significant correlation between years of teaching experience and teacher self-efficacy scores.

3. Is there a significant correlation between the hours spent in technology professional development and teacher self-efficacy scores?

Ho3. There is no significant correlation between the hours spent in technology professional development and self-efficacy scores.

4. Is there a significant correlation between teacher age and technology use in the classroom?

Ho4. There is no significant correlation between teacher age and technology use in the classroom.

5. Is there a significant correlation between years of teaching experience and technology use in the classroom?

Ho5. There is no significant correlation between years of teaching experience and technology use in the classroom.

6. Is there a significant correlation between the hours spent in technology professional development and technology use in the classroom?

Ho6. There is no significant correlation between the hours spent in technology professional development and technology use in the classroom.

7. Is there a significant correlation between teacher self-efficacy scores and technology use in the classroom?
Ho7. There is no significant correlation between teacher self-efficacy scores and technology use in the classroom.

8. Is there a significant difference between the teacher self-efficacy scores of males and females?
Ho8. There is no significant difference between the teacher self-efficacy scores of males and females.

9. Is there a significant difference between the classroom technology use of females and males?
Ho9. There is no significant difference between the classroom technology use of females and males.

Instrumentation

A survey instrument will be used with 11 questions regarding demographics, self-efficacy, technology use, and professional development. All questions regarding self-efficacy are based on a four-point Likert-type scale. Permission to use the teacher self-efficacy scale developed by Schwarzer, Schmitz, and Daytner (1999) is available for free and is copyrighted by Ralph Schwarzer on his website. The survey has been created in a way that requires all participants to answer each question. Participants will be advised that the survey will be used for the purpose of research, all responses are confidential, participation is voluntary, and the information collected will not be used to identify participants in any way.

Perceived self-efficacy will be gathered by using the teacher self-efficacy scale constructed by Schwarzer, Schmitz, and Daytner (1999). The instrument consists of 10 statements that identify job skills and group them into four major areas: job accomplishment, skill development on the job, social interaction with parents, students, and colleagues, and coping with job stress.
Schwarzer (1999) identified these four areas to be critically important to effective teaching. These statements are broken down into two questions that require the participant to rate their self-efficacy on a scale of zero to three with one being not at all true and three being exactly true according to each statement given. Twenty-seven items assess these major areas explicitly following Bandura’s social cognitive theory (1997). Bandura’s theory contains a precise structure for self-efficacy items. All items should have the subject “I” to assess an individual’s subjective belief. The words, “can” and “able,” should be used to identify the fact that the item relates success to personal competence. The items must also include a barrier because self-efficacy expectancies should contain tasks that are considered difficult. The 27 items will be narrowed down to 10 to effectively assess self-efficacy beliefs with a focus on enhancing the validity in the four areas mentioned.

Population

The population for this study consists of teachers at 3 different schools in grades kindergarten through twelve across 2 school districts in East Tennessee. Teachers within these two districts received a survey via email link. Participation was voluntary.

Data Collection

Permission was obtained from the Director of Schools to collect data for this research study by way of email to prepare for the IRB approval process. Prior to the beginning of this research project, permission to conduct the research was also obtained from the Institutional Review Board (IRB) at Carson-Newman University. The survey was distributed, following IRB approval, by a link via Survey Monkey.
Data Analysis

Data from the survey instrument will be analyzed through a non-experimental quantitative methodology. Statistical Package for Social Sciences (SPSS) data analysis software will be used to conduct all data analysis procedures for this study.

All research questions contain a corresponding null hypothesis for a total of nine research questions and nine null hypotheses. Research questions 1 through 7 will be analyzed using a series of Pearson and Spearman correlation tests. Questions 8 and 9 will be analyzed using independent t-tests.

Chapter 4

Analysis of Data

The purpose of this study was to identify the combination of factors that apply to the implementation of new technologies in the classroom. It specifically analyzed the teacher’s age, years of experience teaching, the quantity of professional development, and teacher self-efficacy to assess the manner in which these factors influence implementing new technologies in the classroom. Participants of the study included classroom teachers in grades K-12 in two different east Tennessee school districts.

This chapter presented and analyzed data to answer nine research questions and nine null hypotheses. Statements were analyzed from statements regarding self-efficacy using a four-point Likert-type scale. The other questions pertaining to demographic content and classroom technology usage information employed a multiple-choice format for analysis of data. The survey was distributed twice and garnered twenty-three responses. Participants were informed that all responses were confidential, and the demographic information collected did not identify participants in the study.
Research Question 1

Research Question 1: Is there a significant correlation between teacher age and teacher self-efficacy scores?

Ho1: There is no correlation between teacher age and teacher self-efficacy scores.

A Pearson correlation coefficient was computed to test the relationship between teacher age and teacher self-efficacy scores. Although data analysis showed a very weak, negative correlation between teacher age ($M = 43, SD = 10.047$) and teacher self-efficacy scores ($M = 2.370, SD = .0375$) the correlation was statistically significant, $r(21) = -.007, p = 3.890 \times 10^{-15}$ (see Table 1). As a result of the analysis, the null hypothesis was rejected suggesting teacher age does play a significant role in the self-efficacy of teachers. Analysis was performed using questions 2, 5, and 6 from the survey.

<table>
<thead>
<tr>
<th>Teacher Age</th>
<th>Mean Self-Efficacy Score</th>
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<tr>
<td>25-34</td>
<td>2.425</td>
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<tr>
<td>35-44</td>
<td>2.51</td>
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<tr>
<td>45-54</td>
<td>2.34</td>
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<tr>
<td>55-64</td>
<td>1.583</td>
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</table>

Research Question 2

Research Question 2: Is there a significant correlation between years of teaching experience and teacher self-efficacy scores?

Ho2: There is no significant correlation between years of teaching experience and teacher self-efficacy scores.

A Spearman correlation coefficient was computed to test the relationship between years of teaching experience and teacher self-efficacy scores. The results of the analysis indicated a
weak, positive relationship between years of teaching experience \((M = 15.883, SD = 5.095)\) and mean self-efficacy score \((M = 2.370, SD = .375)\) yielding a correlation that was statistically significant, \(r(21) = .181, p = 2.96 \times 10^{-11}\). As a result, the null hypothesis was rejected. Therefore, the results suggest the number of years of teaching experience plays a significant role in the self-efficacy of teachers. Analysis of this question used items 3, 5, and 6 from the survey.

<table>
<thead>
<tr>
<th>Years of Experience</th>
<th>Mean Self-Efficacy Score</th>
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<tr>
<td>0-3</td>
<td>2</td>
</tr>
<tr>
<td>4-10</td>
<td>2.325</td>
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<tr>
<td>11+</td>
<td>2.4</td>
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</table>

Research Question 3

Research Question 3: Is there a significant correlation between hours spent in technology professional development and teacher self-efficacy scores?

Ho3: There is no significant correlation between hours spent in technology professional development and teacher self-efficacy scores.

A Spearman correlation coefficient was computed to test the relationship between the hours spent in technology professional development and teacher self-efficacy scores. The analysis revealed a weak, positive relationship between hours spent in technology professional development \((M = 7.587, SD = 6.157)\) and teacher self-efficacy scores \((M = 2.37, SD = .375)\). Analysis also showed data was statistically significant and the null hypothesis was rejected, \(r(21) = .143, p = 6.455 \times 10^{-4}\). In general, the results suggest that hours spent in professional development do play a significant role in the self-efficacy of teachers. Items 5, 6, and 10 from the survey were used in the analysis.
Table 3. Hours of technology professional development compared to mean self-efficacy score.

<table>
<thead>
<tr>
<th>Hours of Technology Professional Development</th>
<th>Mean Self-Efficacy Score</th>
</tr>
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<tr>
<td>0-4</td>
<td>2.13</td>
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<td>5-10</td>
<td>2.4</td>
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<tr>
<td>10-15</td>
<td>2.15</td>
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<tr>
<td>16+</td>
<td>2.45</td>
</tr>
</tbody>
</table>

Research Question 4

Research Question 4: Is there a significant correlation between teacher age and technology use in the classroom?

Ho4: There is no significant correlation between teacher age and technology use in the classroom?

A Pearson correlation coefficient was calculated to test the correlation between teacher age and technology use in the classroom. The analysis revealed a weak, positive correlation between teacher age ($M = 43$, $SD = 10.047$) and technology usage in the classroom ($M = 1.084$, $SD = .423$). The correlation was statistically significant, and the null hypothesis was rejected, $r(21) = .184$, $p = 2.002 \times 10^{-15}$. Thus, there is a relationship between teacher age and technology use in the classroom. Items 2, 7, 8, and 9 from the survey were used in this analysis.

Table 4. Teacher age and technology use in the classroom.

<table>
<thead>
<tr>
<th>Teacher Age</th>
<th>Mean Classroom Technology Use</th>
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<tbody>
<tr>
<td>25-34</td>
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<td>35-44</td>
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<td>45-54</td>
<td>1.347</td>
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<td>55-64</td>
<td>1.017</td>
</tr>
</tbody>
</table>

Research Question 5

Research Question 5: Is there a significant correlation between years of teaching experience and technology use in the classroom?
Factors Affecting Technology Implementation

Ho5: There is no significant correlation between years of teaching experience and technology use in the classroom.

A Spearman correlation coefficient was calculated to test the association between years of teaching experience and technology use in the classroom. The analysis showed a weak, positive relationship between years of teaching experience ($M = 15.370, SD = 5.095$) and technology use in the classroom ($M = 1.084, SD = .423$). The correlation was not statistically significant $r(21) = .221, p = 5.883 \times 10^{-12}$. The null hypothesis was rejected, suggesting that years of teaching experience is related to technology use in the classroom.

Table 5. Years of teaching experience and technology use in the classroom.

<table>
<thead>
<tr>
<th>Years of Teaching Experience</th>
<th>Technology Use in the Classroom</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3</td>
<td>0.967</td>
</tr>
<tr>
<td>4-10</td>
<td>0.733</td>
</tr>
<tr>
<td>11+</td>
<td>1.137</td>
</tr>
</tbody>
</table>

Research Question 6

Research Question 6: Is there a significant correlation between the hours spent in technology professional development and technology use in the classroom?

Ho6: There is no significant correlation between the hours spent in technology professional development and technology use in the classroom.

A Spearman correlation coefficient was calculated to test the relationship between hours spent in technology professional development by teachers and technology use in the classroom. The results of the question analysis from the survey showed a weak, positive correlation between hours spent in technology development ($M = 7.587, SD = 6.157$) and the use of technology in the classroom ($M = 1.084, SD = .423$); the null hypothesis was rejected, $r(21) = .237, p = 5.906 \times 10^{-5}$. The analysis showed that there was a relationship between the number of hours spent in
technology professional development and technology use in the classroom. The analysis of question 6 was performed using questions 7, 8, 9, and 10 from the survey.

Table 6. Hours spent in technology professional development and technology use in the classroom.

<table>
<thead>
<tr>
<th>Hours in Technology Professional Development</th>
<th>Technology Use in the Classroom</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4</td>
<td>0.933</td>
</tr>
<tr>
<td>5-10</td>
<td>1.075</td>
</tr>
<tr>
<td>11-15</td>
<td>1.667</td>
</tr>
<tr>
<td>16+</td>
<td>1</td>
</tr>
</tbody>
</table>

Research Question 7

Research Question 7: Is there a significant correlation between teacher self-efficacy scores and technology use in the classroom?

Ho7: There is no significant correlation between teacher self-efficacy scores and technology use in the classroom.

A Pearson correlation coefficient was calculated to assess the relationship between teacher self-efficacy scores and technology use in the classroom. The results showed a moderate, positive correlation, \( r(21) = .465, p = 1.025 \times 10^{-13} \) and was statistically significant. The null hypothesis was rejected supporting the conjecture that there is a correlation between teacher self-efficacy scores \((M = 2.37, SD = .375)\) and technology use \((M = 1.084, SD = .423)\) in the classroom. Questions 5, 6, 7, 8, and 9 were used from the survey in this analysis.

Research Question 8

Research Question 8: Is there a significant difference between the teacher self-efficacy scores of males and females?

Ho8: There is no significant difference between the teacher self-efficacy scores of males and females.
An independent samples t-test was utilized to evaluate whether self-efficacy scores of males differed from those of females. The mean score on the self-efficacy test \((M = 2.42, SD = .394)\) was the testing variable and the grouping variable was the gender \((M = 2.368, SD = .371)\) of the participants. The test was not statistically significant, \(t = .149, p = .888\) which meant the null hypothesis was not rejected (see Figure 8). The results showed there was no significant difference for self-efficacy scores of males and females. Questions 1, 5, and 6 were used in this analysis.

Research Question 9

Research Question 9: Is there a significant difference between technology use in the classroom of males and females?

Ho9: There is no significant difference between the classroom technology use of females and males.

An independent samples t-test was used to assess whether there was a significant difference between the classroom use of technology of females and males. Technology use by both genders was measured using a survey instrument with the mean technology score of males \((M = 1.067, SD = 1.067)\) and the mean technology score of females \((M = 1.084, SD = .442)\). The score on the technology use questions of the survey was the testing variable while the gender was the grouping variable. The results failed to reject the null hypothesis, \(t = -.087, p = .934\) and indicated there was a difference between females and males regarding technology use in the classroom. In order to conduct this analysis, questions 1, 7, 8, and 9 were used from the survey.
CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS FOR FUTURE PRACTICE AND RESEARCH

The findings, conclusions, implications for practice, and suggestions for future research are summarized in this chapter. The purpose of this study was to identify the combination of factors that pertain to implementing new technologies in the classroom. Explicitly, the study analyzed the age of the teacher, years of teaching experience, hours spent in technology professional development, and teacher self-efficacy to examine the way these factors are related to implementing new technologies in the classroom. This was a replication of an earlier study. The results of this study could be used by readers as a resource for factors that contribute to success when considering the introduction or revision of practices pertaining to employing new technologies in the classroom. The study was conducted using data collected from an online survey from 3 different schools in 2 different districts in east Tennessee.

Summary

The statistical analysis in this study was based on nine research questions and nine null hypotheses outlined in Chapters 1 & 3. Data gathered from questions 1, 2, 3, 4, 5, 6, and 7 were analyzed using a Pearson correlation coefficient and questions 8 and 9 were analyzed using independent sample t-tests. There was a total of 23 participants in grades K-12. The level of significance used in the study was .05. Findings seemed to indicated technology use and self-efficacy were affected by teacher age, hours of professional development, years of experience, and gender.
Conclusions

The purpose of this study was to identify which factors, if any, affected the implementation of new technologies in the classroom. The specific factors analyzed were the age of the teacher, years of teaching experience, quality of professional development, and teacher self-efficacy and the way in which each related to the implementation of new technologies in the classroom. Based on the study’s findings, the following conclusions were drawn.

1. There was a correlation between teacher age and the self-efficacy of teachers, using analysis obtained from questions 1, 5, and 6 in the survey. Teachers in the 25-34 age group reported a mean self-efficacy score of 2.425, 35-44 reported a mean self-efficacy score of 2.51, 45-54 reported a mean self-efficacy of 2.34, and 55-64 reported a mean self-efficacy score of only 1.581. These findings did not corroborate those of Bandura (1995) or those of Tweed (2013), both of which concluded age doesn’t correlate with self-efficacy.

2. A correlation was found between years of teaching experience and the self-efficacy of teachers. Those with 0-3 years of experience reported a mean self-efficacy score of 2, 4-19 years reported a mean self-efficacy score of 2.35, and those with 11 or more years of experience reported a mean self-efficacy score of 2.4. These findings mirrored those of Bandura (1995) and Tweed (2013). Questions 3, 5, and 6 from the survey were used in the analysis. Thus, self-efficacy may not be static and may indeed change over time.

3. A significant relationship was found to exist between hours spent by teachers in technology professional development and teacher self-efficacy. This finding contradicts the conclusion of Tweed (2013). The findings of this study suggest the hours spent in technology professional development do influence teacher self-efficacy. These findings
are supported by Bray-Clark and Bates (2003) who found the self-efficacy construct can provide administrators and school leaders with the necessary means to design effective educator training, improve teacher competence, and increase student success rates. This study considered only the number of hours spent in technology professional development and did not attempt to measure the quality of such professional development.

4. The data showed a relationship between teacher age and technology use in the classroom. Teachers in the 25-34 age category had a mean classroom technology use of 0.88, those in the 35-44 age category had a mean classroom technology use of 1.04, those in the 45-54 age category had a mean classroom technology use of 1.34, and those in the 55-64 age category had a mean classroom technology use of 1.01. These findings came from analysis of items 2, 7, 8, and 9 from the survey. The findings of this study contradict the findings of research by Tweed (2013) who concluded age had no effect on classroom technology use.

5. This study also found a relationship between the number of years of teaching experience and technology use in the classroom. Teachers with 0-3 years of experience had a mean classroom technology use score of 0.96, those with 4-10 years of teaching experience exhibited a mean classroom technology use score of 0.73, and teachers with 11 or more years of teaching experience had a mean classroom technology use score of 1.13. Items 2, 7, 8, and 9 were used in the analysis of this research question. These findings did not coincide with the findings of Tweed (2013). That study found no correlation between the number of years of teaching experience and technology use in the classroom.

6. There was a correlation found between the number of hours spent in technology professional development and technology use in the classroom. Teachers with 0-4 hours
of technology professional development had a mean technology use in the classroom of 0.933, those with 5-10 hours of technology professional development had a mean classroom technology use of 1.075, those with 11-15 hours of technology professional development had a mean classroom technology use score of 1.667, and those with 16 or more hours of technology professional development had a mean classroom technology use score of 1. Items 7, 8, 9, and 10 from the survey were used in the analysis of this research question. Again, these findings contradicted the findings of Tweed (2013) who found no correlation between the number of hours spent in technology professional development and the use of technology in the classroom.

7. A significant correlation was found between teacher self-efficacy scores and technology use in the classroom using responses from items 5, 6, 7, 8, and 9 from the survey. These findings corroborated the findings of Tweed (2013). That study also found a significant correlation between teacher self-efficacy scores and technology use in the classroom.

8. No significant difference was found between the self-efficacy scores of males and females. An independent t-test was conducted using items 1, 5, and 6 from the survey. The males who responded to the survey had a mean self-efficacy score of 2.375 while the female respondents had a mean self-efficacy score of 2.368. These findings were supported by the study done by Tweed (2013) who also found no significant difference in the self-efficacy scores of males and females. Uzun, Ozkilic, and Senturk (2010) also found no gender difference in the self-efficacy of teacher candidates. Atta, Ahmad, Ahmed, and Ali (2012) however did find gender differences regarding self-efficacy with females scoring significantly higher than males in that study.
9. This study found a significant difference in the classroom technology use of males and females. The mean classroom technology use of males was 1.067 and that of females was 1.084; the analysis was conducted using items 1, 7, 8, and 9 from the survey. These findings were not supported by the findings of Tweed (2013) who found no significant difference in the technology use in the classroom between males and females. Li (2016) also found gender differences when it came to implementing technology in the classroom with females significantly more likely to implement new technology following training.

Recommendations for Practice

The findings of this study have led to the following recommendations for practice regarding the implementation of new classroom technologies.

1. School leaders should consider implementing new technology and technology programs in schools and classrooms of teachers with high self-efficacy levels.
2. Administrators should consider supporting new technology implementation with appropriate technology professional development and training.

Recommendations for Future Research

Technology instruments, availability, and educational applications are changing rapidly. Many of the technologies and software available to today’s educators and students were unheard of a few years ago. Those that were available then are largely obsolete today. With technology changing so quickly, research regarding the use and implementation of technology in the classroom must be updated frequently. This will enable teachers, administrators, and educational leaders to make informed decisions regarding the use of technology in the classroom. Considering the huge expenditure burden schools face when implementing technology, it is also critical for schools to employ strategies to increase the
likelihood of successful technology implementation. The results of this study suggest two primary recommendations for future research.

First, more research is needed on the quality and type of delivery of technology professional development and their impact on technology implementation in the classroom. Targeted training, peer coaching, and mentorship would be important considerations for professional development and implementing technology in classrooms and should be explored further. The review of literature seemed to suggest localized, teacher-specific professional development was the most effective. With technology changing so rapidly, can school systems continue to provide localized, expert training or will they be forced to employ webinars and social media to provide teacher training? If so, research is needed to find effective measures to counteract the negative effects of less than ideal professional development situations. Thus, more research is needed in those areas which would contribute to the body of knowledge currently available.

Higher levels of teacher self-efficacy were found to significantly impact technology implementation. More research is needed in ways to improve teacher self-efficacy in the use of technology, classroom instruction, and classroom management.

For all the technology innovations and progress in education, implementation is still the major challenge (Herold, 2015). Teachers are struggling to balance technology implementation with their changing role in the education system and their accountability for student academic achievement. Schools that wish to promote increased technology implementation and integration in the classroom must give teachers the tools (i.e. training and support through quality, targeted technology professional development and mentoring) they need to improve the chance for successful implementation.
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Retrieved from:

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[https://doi.org/10.1371/journal.pone.0144008](https://doi.org/10.1371/journal.pone.0144008)


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## Table 1. Teacher age compared to mean self-efficacy score.

<table>
<thead>
<tr>
<th>Teacher Age</th>
<th>Mean Self-Efficacy Score</th>
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<tbody>
<tr>
<td>25-34</td>
<td>2.425</td>
</tr>
<tr>
<td>35-44</td>
<td>2.51</td>
</tr>
<tr>
<td>45-54</td>
<td>2.34</td>
</tr>
<tr>
<td>55-64</td>
<td>1.583</td>
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Table 2. Mean self-efficacy scores of teachers compared to years of teaching experience.

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<tr>
<th>Years of Experience</th>
<th>Mean Self-Efficacy Score</th>
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<tr>
<td>4-10</td>
<td>2.325</td>
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Table 3. Hours of technology professional development compared to mean self-efficacy score.

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<td>2.15</td>
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<td>2.45</td>
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Table 4. Teacher age and technology use in the classroom.

<table>
<thead>
<tr>
<th>Teacher Age</th>
<th>Mean Classroom Technology Use</th>
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<tbody>
<tr>
<td>25-34</td>
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<tr>
<td>35-44</td>
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</tr>
<tr>
<td>45-54</td>
<td>1.347</td>
</tr>
<tr>
<td>55-64</td>
<td>1.017</td>
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</table>
Table 5. Years of teaching experience and technology use in the classroom.

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<td>1.137</td>
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Table 6. Hours spent in technology professional development and technology use in the classroom.

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<td>1.075</td>
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<td>11-15</td>
<td>1.667</td>
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<tr>
<td>16+</td>
<td>1</td>
</tr>
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</table>