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Teachers' Perceptions Of Technology In The Coronavirus Disease 19 Era

Leann Pinkerton

TEACHERS' PERCEPTIONS OF TECHNOLOGY IN THE CORONAVIRUS DISEASE 19 ERA

by

Leann Pinkerton

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Meredith N Young Dissertation Advisor	09.27.2021 Date
Kimberly Towers Dissertation Reader	09/27/2021 Date
Michael Brooks Dissertation Reader	09.27.21 Date
Donny Lee Dean of the Cannon-Clary College of Education	9-27-21 Date
Provost	9/29/21 Date

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ABSTRACT

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Leann Pinkerton
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Title: Teachers' Perceptions Of Technology In The Coronavirus Disease 19 Era (Under the direction of Dr. Meredith Young)

The purpose of this study was to determine if years of experience or grade-level teaching assignment have any effect on teacher perceptions of comfort with technology, teacher perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, or teacher perceptions of technology support available in six central Arkansas school districts. In this quantitative, causal-comparative design study, there were 239 teacher responses to a modified survey combining items from the USEIT survey and the PETI survey for teachers in six school districts in Central Arkansas. The modified instrument consisted of 35 items, including two questions related to years of teaching experience and grade-level teaching assignment. The survey's other 33 questions were divided into four constructs: teacher perceptions of comfort with technology (6 questions), teacher perceptions of technology-based professional development (7 questions), teacher perceptions of obstacles to technology usage (10 questions), and teacher perceptions of technology support available (10 questions). Each respondent completed questions on a 4-point Likert scale ranging from strongly disagree (score of 1) to strongly agree (score of 4) on the digital survey constructed with Google

Forms. Eight independent sample *t*-tests were conducted to address the hypotheses using teacher years of experience (Novice = 0-5 years of experience versus Experienced = 6+ years of experience) and grade-level teaching assignment (Elementary = K-5and Secondary = 6-12) as the independent variables. The dependent variables were teacher perceptions of comfort with technology, teacher perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, and teacher perceptions of technology support available. This study used the Technology Acceptance Model framework. This study did not reveal that years of experience or grade-level teaching assignment influenced teacher perceptions of comfort with technology, teacher perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, or teacher perceptions of technology support available. No significant difference existed between novice and experienced or elementary and secondary teachers in any of the four dependent variables. The first recommendation for educators is related to increasing teacher comfort with technology. Based on this research and the study results, the second recommendation is that the superintendent set a vision to stress the importance of technology. The third set of recommendations are related to best practices for technology-based professional development. The fourth recommendation would be to have found multiple, creative methods of supporting teachers with technology.

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CHAPTER I

INTRODUCTION

Technology in classrooms has evolved exponentially over the last several decades, and teacher perceptions of classroom technology have varied along with the changes based on several factors. Teacher perceptions of technology are complex because perceptions are influenced by the schools' actions and teachers' beliefs (Scherer & Teo, 2019). In addition to the already wide variety of factors influencing the way teachers perceived technology before the coronavirus disease (COVID-19) pandemic, the shutdown caused a global impact on education (McCarthy, 2020). Due to the changes in education related to the COVID-19 pandemic, additional changes in teacher perceptions of technology may have occurred.

Technology has many positive benefits that may influence teacher perceptions. Technology can be used to supplement instruction in core content areas. Dickinson (2016) found that technology resources such as Khan Academy positively affected students' mathematics confidence. Technology also helped instructors create more engaging presentations and allow instructors to provide timely feedback, resulting in higher student ratings of instructors who effectively used technology in their instruction (Davies, Lavin, & Korte, 2009). As well as allowing instructors to create engaging presentations, technology also leads to increased student engagement (Carver, 2016). Teachers realized that the benefits of using technology during their planning time and

their instruction provided them and their students with an ideal learning environment (Morquin, 2016). Teacher perceptions may be influenced by the positive benefits of technology, including creating more time for teachers, creating engaging presentations, and increasing student engagement.

Despite these positive results of using technology in the classroom, not everyone agrees that technology is worth the cost. Cuban (2001) asserted that technology is not worth the associated financial investment and suggested that technology has been oversold. Twenty-five years ago, Goodson and Mangan (1995) contended that core content is often replaced with technological skills. In addition, Weston and Bain (2010) reported that technology investments did not lead to gains in student learning, a position that Dunleavy and Heinecke (2007) also established after studying 1:1 initiatives. More recently, however, Molnar et al. (2019) asserted that virtual learning has inherent problems and recommended slowing virtual schools' growth. Ugur and Koç (2019) observed that regular communication from school leaders about technology investments and efforts is necessary to gain acceptance from all stakeholders and combat the issues with increasing educational technology. School leaders would benefit from understanding that perceptions around technology initiatives vary widely, and initiatives require early communication with all stakeholders. The negative perceptions of technology by some stakeholders may influence teacher perceptions of technology as well.

Guiding this research is the need for exploring elements that affect teachers' perceptions of technology due to remote learning requirements. Although computer-based technology has been in classrooms since the late 1970s (Thornburg, 2014), the need for an investigation into variables that influence teachers' perception of usage of

technology has been heightened because of the COVID-19 pandemic and subsequent school shutdown (Perozek, 2020). Remote learning became ubiquitous as schools were forced to make education available offsite. Teacher usage of technology became universal as implementation became necessary to meet the needs of remote learners. How teachers adapted to this new instructional method could have been affected by elements that influenced their perceptions of technology usage. This study sought to determine if teacher perceptions are influenced by teacher comfort with technology, technology-based professional development, obstacles to technology usage, and technology support available.

Statement of the Problem

First, the purpose was to determine the effects by years of experience between teachers in Grades K-5 versus Grades 6-12 on teacher perceptions of comfort with technology measured by a modified survey combining items from the Use Support and Effect of Instructional Technology (USEIT) survey and the Profiling Educational Technology Integration (PETI) survey for teachers in six school districts in Central Arkansas. Second, the purpose was to determine the effects by years of experience between teachers in Grades K-5 versus Grades 6-12 on teacher perceptions of technology-based professional development measured by a modified survey combining items from the USEIT teacher survey and the PETI survey for teachers in six school districts in Central Arkansas. Third, the purpose was to determine the effects by years of experience between teachers in Grades K-5 versus Grades 6-12 on teacher perceptions of obstacles to technology usage measured by a modified survey combining items from the USEIT teacher survey and the PETI survey for teachers in six school districts in Central

Arkansas. Fourth, the purpose was to determine the effects by years of experience between teachers in Grades K-5 versus Grades 6-12 on teacher perceptions of technology support available measured by a modified survey combining items from the USEIT teacher survey and the PETI survey for teachers in six school districts in Central Arkansas.

Background

Theoretical Framework: Technology Acceptance Model

The success of implementing a new technology initiative often depends on the users' acceptance of the technology. Davis (1987) was the first to develop the Technology Acceptance Model (TAM). He asserted that new technology's perceived usefulness and ease of use would affect a user's attitude toward the technology and how much difficulty the user would endure to adopt the new technology. According to Davis, if the new technology did not make the users' jobs easier, they would not struggle through the technical difficulties to use the technology. Davis's research was conducted for the business world, but his findings are also applicable to teachers using instructional technology. If the new platform, software, or hardware did not seem useful or productive for teachers and relatively easy to use, they would continue to use what they have used in the past. Although the TAM refers to technology acceptance, the term *perception* was used in place of *acceptance* in this study. Teacher perceptions of technology are vital for schools to consider when making a move towards new technology.

Teacher Perceptions of Technology: Teacher Comfort With Technology

Several factors influence teacher perceptions of technology. One of the most significant influences is the type of technology a teacher is comfortable using (Kilicer,

Bardakci, & Arpaci, 2018). While some technology is ubiquitous, such as cell phones, many technology applications require higher-order thinking skills. Kilicer et al. (2018) claimed that educators who use technology to perform complicated tasks positively perceive technology. Kilicer et al. also suggested that although digital natives, raised using technology from an early age, are more comfortable with technology, even digital natives vary widely in their comfort levels with technology skills. Peng and Wong (2018) confirmed that the more experiences teachers have with computers, the more likely they view technology positively. Peng and Wong recommended increased training in classroom activities using technology to increase teacher comfort levels. As comfort levels rise due to increased training and usage, teachers will perform more complex tasks, increasing their positive perceptions of technology.

Teacher Perceptions of Technology: Technology-Based Professional Development

Professional development has a strong effect on teacher perceptions of technology. An outside expert often presents professional development, but Demski (2012) claimed that as the instructional leader, the principal should be equipped to support and even train teachers in technology use. School leaders must model innovative behaviors, and the most successful technology implementations occur where the principal is an effective technology leader. Topper and Lancaster (2013) expressed that superintendents are responsible for setting the vision and stressing that increased technology can positively affect student learning and lifelong skills. Influential school leaders share their vision with all stakeholders, and they will also assist in the implementation when possible. Teachers' responses to effective technology-based professional development will influence perceptions of technology.

As school leaders attempt to provide high-quality technology-based professional development for teachers, they may consider what makes training effective or desirable. Brzycki and Dudt (2005) determined that the technology's inherent appeal determined faculty perceptions of technology. The value the technology could add to teaching, the relevance to the teachers' disciplines, the relationship to other initiatives, and the training package's attractiveness also influenced teacher perceptions (Brzycki & Dudt, 2005). The training package's appeal was partly due to creative professional development session titles and descriptions and the convenience of the professional development schedule, refreshments, and the instructors' quality. Teachers' lack of acceptance was often a barrier to technology use; still, the technology was adopted because the teacher wanted to use technology for a personal project or because the teacher wanted to participate in their children's technology-related activities (Brzycki & Dudt, 2005). Wei, Darling-Hammond, Andree, Richardson, and Orphanos (2009) established that professional development was most effective when teachers learned throughout the school year in professional learning communities. Professional development can best support technology initiatives when the instruction is short, frequent, and applied immediately. Tucker (2019) suggested that short sessions embedded into the professional learning community schedule may be effective for incorporating technology-based professional development. Understanding teachers' perceptions of professional development concerning technology are essential for administrators when considering new technology initiatives.

Teacher Perceptions of Technology: Obstacles to Technology Usage

Obstacles that prevent the effective implementation of different types of technological tools may influence teacher perceptions of technology. Teacher perceptions

can be affected by community support of the technology initiative. Some have questioned the wisdom of investing in technology. Twenty-five years ago, Goodson and Mangan (1995) suggested that teacher perceptions were negatively influenced by the amount of class time teaching technology took away from core content instruction. Lack of communication and teacher acceptance of technology has been blamed for the lack of technology utilization (Kearney, Schuck, Aubusson, & Burke, 2018). Effective school leaders should empower high-quality teachers who have adopted technology to build technology capacity and increase community support, improving positive teacher perceptions. Potential obstacles should be considered at the implementation of technology, so considering how to minimize obstacles and increase favorable teacher perceptions may be worthwhile for school leaders.

Discovering effective means for overcoming obstacles to technology usage is an essential task for school leaders. High faculty turnover and evolving technology require ongoing communication and administrative support (Demski, 2012). If communication fails in technology initiatives, teacher perceptions and subsequent implementation could be jeopardized. Multiple methods should be used by instructional technology support staff to support teachers in technology use, such as providing individual help, classroom mentoring, instructional materials on various skill levels, and onsite professional development. A good relationship between the technical staff, the administration, and teachers will help overcome obstacles associated with adopting and implementing new initiatives.

The obstacles to technology usage associated with virtual learning may negatively affect teacher perceptions of technology. Virtual learning demonstrated poor results

compared to face-to-face learning (Molnar et al., 2019). The National Education Policy Center recommended that virtual schools stop or slow their growth until they improve performance (Molnar et al., 2019). Virtual schools often asserted that they offered individualized learning and can outperform brick and mortar schools in student achievement, but Perozek (2020) argued that the evidence does not support those claims. In addition to poor student achievement, virtual schools also have lower graduation rates than traditional schools (Molnar et al., 2019). Although virtual classrooms did not start in 2020, the issues associated with virtual learning became more prevalent, and the problems virtual schools experienced became nationwide problems that many schools realized. How long students will need to learn remotely because of the COVID-19 pandemic is unknown, but student achievement is declining in the interim, which may negatively affect teacher perceptions of technology.

Teacher Perceptions of Technology: Technology Support

Another critical factor influencing teacher perceptions of technology includes available technology support. Kearney et al. (2018) suggested that investments in technology without available technology support are often wasted investments, and the benefits must outweigh the costs. In addition to technology staff, school leaders can also effectively support technology use (Demski, 2012). Due to the COVID-19 shutdown, the increased volume of technology usage led to increased requests for support from teachers, students, and parents. Castelo (2020) determined that automation of technology requests might be helpful during the high utilization of technology. An automated ticketing system to respond to simple requests such as resetting passwords would free the technology support staff to perform higher-level tasks like providing training and support

for new learning management systems. Various roles throughout the district can provide technology support if leaders can overcome functional fixedness and consider overlooked possibilities (Lubarsky & Thomas, 2020). Blackwell, Lauricella, and Wartella (2014) found that attitudes toward using technology to aid in learning, followed by confidence and perceived technology support, played the most substantial roles in teacher perceptions and intent to use technology. Administration, fellow teachers, library media specialists, and instructional facilitators can all support teachers in technology. Additionally, district leaders should consider creative possibilities for supporting teachers in a time of technology integration.

Possible Teacher Demographics Affecting Teacher Perceptions of Technology

Years of experience may influence teacher perceptions of technology. Peng and Wong (2018) noted that years of teaching experience significantly affected the various types of computer use in the classroom. Peng and Wong's research indicated that teachers who taught with a traditional, teacher-centered approach viewed technology more negatively than student-centered, constructivist educators. Teachers with over 26 years of teaching experience, especially those without high levels of education, had negative attitudes towards technology. Teo (2014) determined that teachers with a shorter length of service rated themselves high on technology perceptions. Teachers with 7 or fewer years of experience had higher ratings on technology perceptions than teachers with more than seven years of experience. Teo recommended that curriculum directors and administrators examine the extent teachers perceive technology's usefulness. A study of the literature related to years of experience and teacher perceptions of technology indicates a possible positive correlation between the years of experience teachers have

and negative teacher perceptions of technology.

Grade-level teaching assignment may also affect teacher perceptions. Teo (2014) determined that elementary teachers rated themselves higher than secondary teachers on technology perceptions; however, Teo found no significant differences between elementary and secondary teachers' perceptions of the technology. Grade-level teaching assignment and years of experience influenced teacher usage of certain technology types, especially Google Classroom (Ballew, 2017). Multiple variables affect teachers' perceptions of technology. Regardless of the subject, teachers' perceived value of technology in the classroom is critical to technology's effective usage.

Coronavirus Disease 19 Shutdown Implications on Teacher Perceptions

Teacher perceptions of technology may have changed due to increased technology usage related to the COVID-19 shutdown and the necessary shift to virtual learning. O'Regan (2020) found that virtual learning offered the ability to pass information but lacked the richness of face-to-face interaction. In the United Kingdom, O'Regan found that the availability of support and instruction that met all stakeholders' needs was crucial for positive perceptions of virtual learning and technology. In the fall of 2020, school districts nationwide developed plans to continue instruction. Many states remained virtual or left the decision to reopen for onsite instruction at the local level ("*Map: Where are schools closed*," 2021), but in Arkansas, districts were required to offer onsite instruction 5 days a week (Perozek, 2020). Most Arkansas districts allowed students to learn virtually while remaining open for students who wished to continue onsite. The pivot to virtual learning and the requisite increase in technology usage during the COVID-19 shutdown may have affected teacher perceptions of technology.

The shift from onsite to virtual instruction happened quickly, and many teachers immediately had to adopt new technology methods. Remote learning brought about many changes, and some of the changes were considered positive. Jacobs and Ivone (2020) concluded that remote learning offered benefits over onsite instruction, especially in student presentations. Educators who were proficient in flipped classrooms, where instruction is provided in the form of videos for students to watch at home while class time was reserved for questions and homework, found remote learning easier than those who had little experience preparing videos. Positive teacher perceptions of comfort with technology may have made the pivot to virtual learning easier. The landscape of education changed in 2020, and some believe classrooms will never fully revert to pre-COVID-19 teaching methods. The pandemic may have affected teaching and learning: the technology knowledge teachers gained during the pandemic may have influenced teachers' perceptions of technology.

Hypotheses

An initial review of the literature suggested teacher perceptions of technology might vary with teaching assignment and years of experience based on teacher perceptions of comfort with technology, teacher perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, and teacher perceptions of technology support available. For this reason, the following hypotheses were generated to guide this study.

1. No significant difference will exist by years of experience between teachers in Grades K-5 versus Grades 6-12 on teacher perceptions of comfort with technology measured by a modified survey combining items from the Use

Support and Effect of Instructional Technology (USEIT) survey and the Profiling Educational Technology Integration (PETI) survey for teachers in six school districts in Central Arkansas.

2. No significant difference will exist by years of experience between teachers in Grades K-5 versus Grades 6-12 on teacher perceptions of technology-based professional development measured by a modified survey combining items from the USEIT teacher survey and the PETI survey for teachers in six school districts in Central Arkansas.
3. No significant difference will exist by years of experience between teachers in Grades K-5 versus Grades 6-12 on teacher perceptions of obstacles to technology usage measured by a modified survey combining items from the USEIT teacher survey and the PETI survey for teachers in six school districts in Central Arkansas.
4. No significant difference will exist by years of experience between teachers in Grades K-5 versus Grades 6-12 on teacher perceptions of technology support available measured by a modified survey combining items from the USEIT teacher survey and the PETI survey for teachers in six school districts in Central Arkansas.

Description of Terms

Blended Learning. Blended learning consists of delivering content onsite and remotely using traditional, onsite teaching methods in addition to technological platforms like Google Classroom, Canvas, or other learning management platforms (Longo, 2016).

Google Classroom. Google Classroom is a tool that helps teachers manage coursework. Google Classrooms allows teachers to create classes and assignments, grade student work, send feedback, and keep everything in one area for each class. Google Classroom is a part of the G Suite for Education products (Google, 2020a).

Google Meet. Google Meet is a digital platform for people to meet virtually via computer or phone from remote locations. Google Meet is a part of the G Suite for Education products (Google, 2020b).

Levels of Teaching. For ESSA accountability purposes, Arkansas groups schools into three grade spans, elementary (PK-5), middle (6-8), and secondary (9-12) (Division of Elementary and Secondary Education, 2021b). A wide range of grade span configurations in school buildings across the state can be found. Teacher licensure in Arkansas is also divided into various grade spans for different subject areas. This study will refer to elementary as Grades K-5 and secondary as Grades 6-12.

Profiling Educational Technology Integration (PETI) survey. The Profiling Educational Technology Integration (PETI) survey, developed by the State Education Technology Director Association (SETDA, 2020), measures teacher perceptions of technology.

Remote Learning. Remote learning is an instructional model that allows teachers and learners to remain connected and engaged with the content and each other while working from their homes. Students frequently use school-provided Chromebooks, and teachers often use videoconferencing and content management systems to connect and provide instruction. Some schools may also provide Internet connectivity (Ray, 2020).

Teacher Years of Experience. Teachers in this study are divided into two categories: Novice teachers (5 years or fewer of classroom teaching experience) and Experienced teachers (6 years or more of classroom teaching experience). Although Arkansas considers novice teachers to be in their first three years of teaching, other states classify novice differently, and Teo (2014), an expert in the subject of teacher perceptions of technology, frequently uses seven years and under as beginning teachers (Division of Elementary and Secondary Education, 2021d).

USEIT teacher survey. The Use, Support, and Effect of Instructional Technology teacher survey measures teacher perceptions of technology integration and was created by Russell, Bebell, and O'Dwyer (2003) at Boston College.

Zoom. A digital platform for people to videoconference and meet virtually via computer or phone from remote locations (Zoom Video Communications, 2020).

1:1 Initiative. The 1:1 initiative is a school program where each student is provided a Chromebook, laptop, or iPad (Warschauer, Zheng, Niiya, Cotton, & Farkas, 2014). In some districts, 1:1 means that the student can take the devices home each day, and other districts use 1:1 to mean that one device per student is available at school through a mix of stationary computer labs, laptop carts, and iPads.

Significance

In March of 2020, the importance of teacher perceptions of technology became apparent when the world was affected by the COVID-19 pandemic. In the United States, schools had to adopt new safety guidelines to reopen (Centers for Disease Control and Prevention, 2021). Teachers were required to use technologies that some were not necessarily comfortable with as they attempted to remotely deliver instruction, often

without prior professional development in how to deliver virtual instruction, when schools closed to onsite instruction. Products like Google Classroom, Zoom, and Google Meet became widely used by teachers who had not used these products before the pandemic (Okmawati, 2020). Technology became an integral part of districts' plans for delivering instruction. Teachers were required to use technology to connect with and instruct students from home, often without technology support staff or professional development, regardless of comfort level or technology perceptions.

The extent of change to teacher perceptions due to increased technology in the classroom is an issue stakeholders may consider. With computers in classrooms, Goodson and Mangan (1995) noted that teachers used technology to perform the same tasks rather than new tasks. In pandemic-era learning, teachers who continued with the same tasks they performed onsite may have had more negative perceptions. Cuban (2001) determined in California's Silicon Valley that technology usage was not widespread or consistent because classroom teachers were simply using technology to do what they had always done. Using technology to do what has always been done may apply to pandemic-era teaching and learning as well. Cuban was critical of the overuse of computers in the classroom in 2001 and determined that the appropriate and effective use of technology was rare. Criticisms such as Cuban's demonstrate some lack of community or stakeholder support for technology, influencing current teacher perceptions. Hennessy, Ruthven, and Brinley (2005) researched teacher perspectives on integrating technology into the classroom. Hennessy et al. found that while governments had invested in technology, they had not invested in developing new learning or teaching ways. Historically, teachers' training on technology usage was not thoughtfully planned; therefore, the

classroom change was limited without that guidance. Teacher perceptions of technology may have been affected by a lack of training for the pivot to virtual learning. Effective school leaders may seek to determine how teacher perceptions of technology changed during the pandemic, as positive perceptions may be important to teacher learning in the future.

Research Gaps

Although research on teachers using technology has been conducted, teacher perceptions of technology continue to evolve as rapidly as technology. Research on teacher perceptions of technology during the COVID-19 pandemic is limited. Not all technology-based educational products have been used long enough to have extensive research data. The most commonly used technology platform in Arkansas was Google Classroom (ADE Data Center, 2021b). Google Classroom began in August of 2014 and has continually evolved since its inception. Specifically, Google Meet was added to Google Classroom in April 2020 to meet the demands of teachers and students forced to interact remotely due to COVID-19 (Google, 2020b). Zoom also increased its number of users exponentially (Okmawati, 2020). Other resources that became commonplace for Arkansas teachers were learning management systems like Canvas, Buzz, Lincoln Learning, and Edmodo (ADE Data Center, 2021b). Most Arkansas teachers surveyed in November 2020 responded that they felt comfortable using digital technology to provide instruction, despite only half of the teachers responding that they were trained in their learning management system (Division of Elementary and Secondary Education, 2021c). Professional development providers may meet with a new type of teacher-learner when the current crisis ends—learners who were forced to teach themselves technology out of

necessity. The influence remote technology-based professional development had on teacher perceptions of technology is currently unknown, but the information would be valuable to school leaders. Current research regarding evolving teacher perceptions of technology and the effect of the COVID-19 shutdown is needed.

Possible Implications for Practice

Due to the COVID-19 pandemic, teachers' technology perceptions may have changed due to increased technology usage. Video conferencing and learning management systems became as standard as bells and lockers were before March of 2020. Before that time, professional development on technology-enhanced assignments was often offered as something teachers could optionally incorporate to deliver content more effectively. During the pandemic and subsequent shutdown, learning how to use technology to connect with students and deliver content became necessary as preparations were made for possible future pandemic threats. As schools closed onsite instruction, teachers' perceptions of technology became somewhat less important than the necessity of quickly performing job-related instructional tasks.

Process to Accomplish

Design

A 2 x 2 between-groups, factorial design was used for each hypothesis. Data were obtained in the form of scores from teachers at six school districts in Central Arkansas. The independent variables for all four hypotheses were grade-level teaching assignment (Grades K-5 versus Grades 6-12) and years of experience (0-3 years versus 4 or more years). The four hypotheses' dependent variables were four constructs related to teacher perceptions of technology: teacher perceptions of comfort with technology, teacher

perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, and teacher perceptions of technology support available.

Sample

Data were the perception scores from K-12 teachers at six public school districts in Central Arkansas. Two of the districts were large (7A and 6A), and four were medium-sized (4A and 5A), as classified by the Arkansas Activities Association (2021). The districts varied in racial composition. The six districts reported a range of 37% to 90% of the student population as White. The districts ranged in students' school lunch eligibility level, with 35% to 100% of students in the six districts receiving free or reduced-cost lunch. The schools were A, B, or C schools, as measured by the Arkansas School Report Card (ADE Data Center, 2021a). Officials at each of the six school districts assisted in the distribution of the electronic survey. The survey included responses from teachers in grade levels K-12 and varying years of service.

Instrumentation

The primary instrument was modified from two existing surveys: the USEIT teacher survey, developed by Boston College (Russell et al., 2003), and the PETI teacher survey developed by the SETDA (2004a). The original USEIT instrument captured teacher perceptions of technology through 46 multi-part questions, and the original PETI survey captured teacher perceptions through 55 multi-part questions. The modified instrument consisted of 35 items, including teacher demographics and four constructs: teacher perceptions of comfort with technology, teacher perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, and teacher perceptions of technology support available. Each respondent completed

questions on a 4-point Likert scale ranging from strongly disagree to strongly agree on the digital survey constructed with Google Forms. Permission to modify the USEIT teacher survey was granted in October 2020 via email. Permission for the PETI survey was granted with visible acknowledgment of the source. Reliability for the USEIT teacher survey is .75 using Cohen's Kappas (Russell et al., 2003), and reliability for the PETI survey was reported as generally high using KR-20 by Nordstrom (2003).

Data Analysis

Teachers of varying grade levels and years of teaching experience responded to the survey. A 2 x 2 between-groups, factorial analysis of variance (ANOVA) was used to analyze each hypothesis. The independent variables for Hypotheses 1-4 were grade-level teaching assignment divided into two levels (Grades K-5 versus Grades 6-12) and years of experience divided into two levels (0-3 years versus 4 or more years). The dependent variables for the four hypotheses were teacher perceptions of comfort with technology, teacher perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, and teacher perceptions of technology support available, respectively. A two-tailed test with a .05 significance was used to test the null hypotheses.

Summary

As technology has changed lives over the last several decades, technology has also changed classrooms. In the late 1970s and early 1980s, technology in the classroom consisted of one or two desktop computers, including the teacher's (Thornburg, 2014). Technology in classrooms has now evolved where most students have a device to use in the classroom, carry home, or learn 100% from home (Perozek, 2020). In March of 2020

and the months that followed, due to the stay-at-home mandates prompted by the COVID-19 pandemic, most teachers, regardless of their comfort levels with technology, had to adapt to teaching remotely, at least part of the time. If the entire school was not virtual, often a percentage of students were, so lessons had to be made available for onsite and virtual students. Videoconferencing, recording video lessons, and online learning platforms became ubiquitous tools of the new teaching era. The high cost of technology investments necessitates technology usage, so effective school leaders should consider teacher perceptions when adopting and purchasing technology programs and equipment. This study seeks to determine if years of teaching experience and grade-level teaching assignment affect teacher perceptions of comfort with technology, teacher perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, and teacher perceptions of technology support available. A review of the related literature surrounding this topic follows in Chapter II.

CHAPTER II

REVIEW OF THE RELATED LITERATURE

Technology in schools has increased dramatically over the last half a century, and teacher perceptions of technology have evolved along with the changes. Teachers use technology to supplement core instruction, create engaging presentations, and complete their work-related tasks. In the era of COVID-19, teachers also used technology to facilitate remote learning. Teacher perceptions of technology were influenced by many factors, including the schools' actions and teacher beliefs about the perceived usefulness of the product (Scherer & Teo, 2019). Teacher perceptions were also influenced by the positive benefits of technology in the classroom and the sometimes-negative community perceptions of increased technology in schools. Teachers may find that technology enhances student learning in the classroom, but community support for technology has been inconsistent over the decades. For the last 2 decades, Cuban (2001) has criticized technology in classrooms, asserting that technology was an expensive investment that did not lead to student achievement gains. In addition to personal beliefs and community perceptions, teacher perceptions of technology may also be impacted by teacher perceptions of comfort with technology, teacher perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, and teacher perceptions of technology support available.

In 2020, during the COVID-19 pandemic, teachers were required to offer instruction in both onsite and virtual learning environments. This duel instruction presented several obstacles which may have influenced their perceptions of technology. Obstacles such as lack of student devices, lack of Internet access, and lack of infrastructure in the community affected many stakeholders, including teachers (Perozek, 2020). Some teachers were unprepared for the skills needed to pivot to remote learning (Ferdig, Baumgartner, Hartshorne, Kaplan-Rakowski, & Mouza, 2020). These issues may have influenced teacher perceptions of technology in the classroom. Teacher perceptions of comfort with technology, teacher perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, and teacher perceptions of technology support available may have affected technology integration positively or negatively. These issues were amplified during the COVID-19 era.

This chapter reviewed the related literature surrounding technology perceptions via the TAM framework and the history of technology in the classroom. Influences on teacher perceptions were centered around the four dependent variables: teacher perceptions of comfort with technology, teacher perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, and teacher perceptions of technology support available. Subsequently, teacher demographics that may affect technology, such as years of experience, grade-level teaching assignment, and pre-service training, may affect these variables. These influential factors will be examined.

Theoretical Framework: Technology Acceptance Model

The theoretical framework that best supports this research is related to the acceptance of technology, referred to as the TAM. The term *perception* will be used in place of *acceptance* in this research when discussing teacher acceptance of technology. Davis created the TAM in 1987 for the business market (Davis, 1987). In the image below, a user's perceived usefulness of the technology and the perceived ease of use will influence the user's attitude toward implementing the technology, leading directly to the use of the technology. When a teacher is introduced to technology, the technology's usefulness and ease will influence the teacher's perception of the technology and influence whether the teacher uses the technology. For example, if a teacher is shown Google Classroom as a method to post and accept assignments, how useful the teacher finds Google Classroom for classwork management, along with how easy the teacher finds Google Classroom to use, will influence the teacher's attitude or perception toward Google Classroom which will determine whether the teacher uses Google Classroom. Actual system usage is influenced by the perceptions of the user, according to the TAM framework. Perceptions will be measured to determine successful implementation.

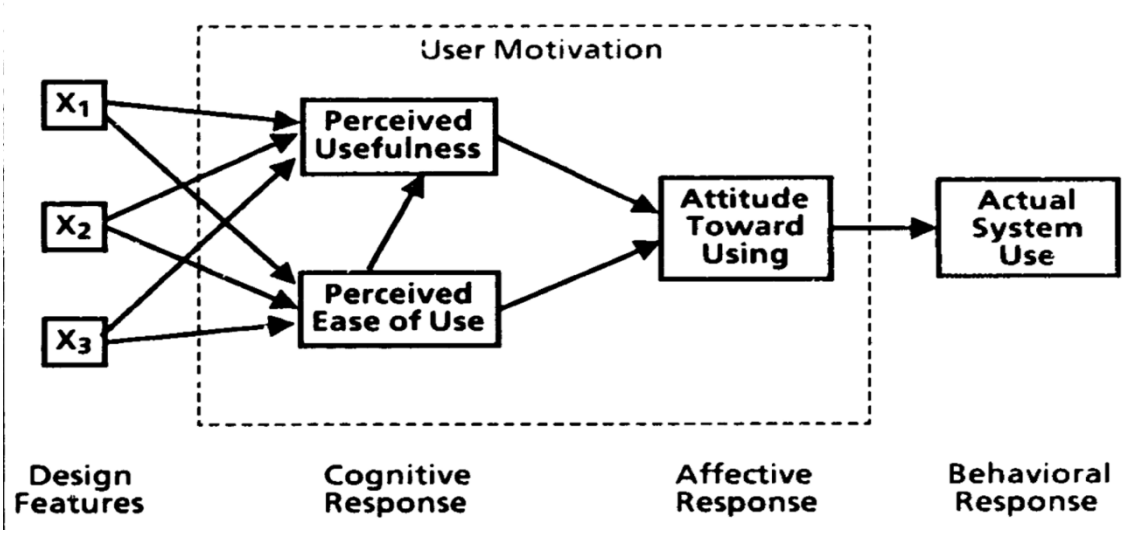

Figure 1. Technology Acceptance Model (TAM; Davis, 1986). Reprinted with permission.

As indicated by the TAM framework, the perceived ease of use of the technology influences teacher perceptions of technology. Teachers' general attitudes toward change are also critical. Teachers need to know how much effort is required to use the technology. If the amount of effort required is too high, the positive perceptions of the technology are lessened. The amount of perceived technology support available also affects teachers' perceptions of technology, supported by the ease-of-use factor in the TAM framework. In 2019, Scherer and Teo (2019) performed a meta-analysis of the TAM related to teachers and reaffirmed that the TAM is a powerful model that determines teachers' intentions to use technology. School administrators may consider ease of use of possible new technology products or services to keep teacher perceptions of technology positive.

Although Davis was the first to develop the TAM, the TAM continued to evolve as various industries studied it. Teo (2014) built upon Davis' work concerning educators and technology perceptions. Teo, like Davis, asserted that teachers must find the technology applicable to their jobs to accept the difficulties associated with adopting technology. Like Davis, Teo claimed that perceived usefulness and perceived ease of use affect teacher perceptions of technology. Administrators' efforts towards technology adoption may be realized if teachers believe that adoption will increase their productivity (Teo, 2014). The TAM framework may be considered as districts attempt to adopt new technology-based initiatives or move to new digital learning management platforms. Teachers must find the technology helpful and believe that technology will increase productivity to implement the product thoroughly. The TAM applies to all users of technology, especially educators using instructional technology in the classroom.

The TAM framework to consider teacher perceptions of technology has proven effective, but the TAM is not a static framework. Sauro (2019) asserted that the TAM is continually evolving and improving. The TAM framework demonstrated the necessity of teachers believing in the benefit the technology provides. Because of the financial costs associated with technology initiatives, ensuring positive teacher perceptions of technology is critical. One example of the necessity of ensuring positive teacher perceptions can be found in Australia. Kearney et al. (2018) demonstrated that Australia had invested significant funds into interactive whiteboards, but the investment was considered a top-down approach, and the whiteboards were not well utilized in classrooms. The teachers had not been consulted before the implementation process began. Formal professional development options were the dominant training options for

the whiteboards, but less formal, teacher-led professional development sessions were found to be more productive. Considering all of the TAM framework factors could help administration and curriculum directors determine the likelihood of a technology initiative's success before making a costly investment. Teacher perceptions are critical to technology integration, and self-initiated professional learning is necessary to adopt a new type of technology effectively.

Historical Overview of Technology in the Classroom

Depending on the definition of technology, one could argue about the beginning of technology in the classroom. For most, technology is commonly considered to be computers. In 1989, Tim Berners-Lee invented the World Wide Web, which later became known as the Internet, while working at the European Organization for Nuclear Research (CERN, 2020). The Internet started as a way of linking documents together and storing these documents on a server. Since the inception of the Internet, numerous developments have occurred in educational technology. According to Venezky (2004), studies undertaken in the late 1990s by the Organization for Economic Cooperation and Development revealed that education was undergoing a shift from rote-learning and shallow but comprehensive understanding to individualistic learning practices, higher-level thinking skills, problem-solving ability, and cooperative learning. In the last two decades, school devices have drastically increased (Carver, 2016). Schools have evolved from one computer per classroom and one lab per building to 1:1 devices, Smartboards, video conferencing tools, and web-based learning management systems. These changes have allowed rich, engaging benefits for students and teachers (Carver, 2016). With the growth of classroom technology, educational practices have evolved. These rapidly-

developing changes due to technology can potentially influence teacher perceptions of technology.

Teacher perceptions of technology in the classroom have certainly changed over the decades. Twenty-five years ago, Goodson and Mangan (1995) indicated that some teachers were concerned that they lost instructional time for their core content due to the time required to teach students how to use technology. Goodson and Mangan reported tension from teachers because teaching technology skills took time away from assessment preparation, affecting accountability and perceived job performance. Teachers wanted to use technology effectively to add educational value rather than add additional features to make projects or presentations appear more attractive without changing the research's substance. Goodson and Mangan reported that teachers were concerned that the overuse of technology might detract from learning core content knowledge required in each subject. Handwriting and basic numeracy skills were content skills that have been replaced mainly by technology. Goodson and Mangan concluded that technology could be appealing to teachers, but they felt that the temptation for overuse must be resisted and that the focus must be maintained on learning objectives. The constancy of learning objectives and assessments in core content areas likely influenced teacher perceptions of the necessity of technology integration compared to the necessity of teaching assessed standards. Teachers' positive perceptions are tied to the perceived value of the product, and teaching technology or with technology may not have carried the value of teaching assessed standards.

Several factors influenced the perceptions of technology as useful to teachers, and perceived usefulness did not always translate to actual system usage. In contrast with the

TAM, Yidana (2007) concluded that teacher perceptions towards technology integration into the teacher education curriculum did not significantly relate to technology use in teaching. Gorder (2008) revealed that teacher integration of technology was compared based on gender, age, number of years in the teaching field, grade-level teaching assignment, content area, and education level. Gorder's results suggested that teachers who used technology regularly for professional productivity tasks were more likely to integrate technology in the classroom. Gorder's results align with the TAM, as perceived ease of use from previous experience with technology will influence teacher perceptions.

Personal and demographic characteristics of teachers had little difference in perceptions of technology integration. The only significant difference in technology integration and uses was grade level (Gorder, 2008). Teachers in Grades 9-12 tended to integrate and use technology more than teachers in Grades K-5 or Grades 6-8. Ballew (2017) suggested that grade-level teaching assignment and the subject taught influenced teacher perceptions and technology usage. Gorder and Ballew have differing results when examining the factors that influence teacher perceptions of technology. Several factors or a combination of those factors could ultimately play a role in teacher perceptions of technology.

As classroom technology has increased over the last few decades, the necessity of teacher knowledge of technology platforms has remained constant. Educator perceptions of technology and the success of virtual instruction are strongly influenced by prior knowledge of the multiple platforms teachers are asked to use (Wright, 2017). Increasing teacher knowledge of digital learning platforms before using the platforms was necessary and would ease implementing digital learning when the need arose. In 2020, Google

Classroom, Google Meet, Zoom, Lincoln Learning, BUZZ, ADE Digital Sandbox, and Teacher Access Center were platforms used by Arkansas educators more frequently than ever before (ADE Data Center, 2021b). The necessity of remote instruction during the COVID-19 pandemic required increased usage of these platforms. Google Classroom has been used successfully by many teachers for several years (Morquin, 2016), so usage of this platform during the pandemic was not as challenging as new platforms. Marks (2020) reported that drones, robots, and teleportal machines that produce a holographic image would soon replace video conferencing, so the need for training on new technology will continue. Teachers' prior knowledge of some platforms, like Google Classroom, made implementation more successful than lesser-used platforms. The importance of teachers' understanding of digital platforms cannot be overlooked when implementing successful technology integration. Once the COVID-19 shutdown began, technology implementation became widespread, and new technology skills became necessary for teachers. Teacher perceptions are evolving as rapidly as technology evolves, and the requirement to incorporate technology into classrooms is increasing, mainly due to the COVID-19 shutdown.

Teacher Perceptions of Technology

Teacher Perceptions of Technology: Teacher Comfort With Technology

Teacher perceptions of technology are affected by teacher comfort with technology. Morquin (2016) asserted that teachers realized the benefits of using technology products such as Google Classroom during their preparation and instruction. Google Classroom provided teachers and students with an ideal learning environment, positively influencing teacher perceptions of technology. In contrast, Azhar and Iqbal

(2018) found that some commonplace technologies were helpful for teacher and student document management but had little influence on methodology. Kilicer et al. (2018) asserted that teacher innovativeness was a predictor of teacher usage of technology. Kilicer et al. also affirmed that technology usage was an integrated part of life for those learners considered digital natives, but a wide variance in technology usage was found even within teachers of the same age. Comfort with technology correlated with the TAM's perceived ease of usage.

Technology causes anxiety in some teachers, and anxiety in any occupational setting will influence performance and perceptions. Teacher anxiety surrounding educational technology usage may decrease the implementation of technology in the classroom. Atabek (2020) revealed that females were more anxious about using educational technology than males, and teachers' ability to use educational technology in the classroom was associated with self-efficacy beliefs. Anxiety about technology usage seems to deter individuals away from using educational technology for instruction. Atabek's findings revealed that negative perceptions of technology caused teachers to question their competency, increasing anxiety and depression. The availability of computers in teachers' homes also affected perceptions. Ultimately, Williams, Coles, Wilson, Richardson, and Tuson (2000) concluded that teachers are the most important agents of technology implementation. Teachers who struggle with collaborative learning, sharing resources and working spaces, and relinquishing control for student-driven learning experienced the most negative perceptions of technology. Administrators' thoughtful preparation for increasing teacher comfort levels with technology may increase positive teacher perceptions of technology.

Teacher Perceptions of Technology: Technology-Based Professional Development

The professional development of teachers is key to successful, positive technology perceptions. Lee and Min (2017) suggested that educator perceptions would determine professional development efficacy. The teachers' perceived need to grow in teaching practices and participate in specific professional development will affect teachers' acceptance of new methods. Professional development in technology should begin in the university's teacher education program (Hoffman & Ramirez, 2018). Developing an educational technology program can help teacher training institutions strengthen teachers' self-efficacy and positive perceptions of educational technology. Whether pre-service or for classroom teachers, a successful professional development session should demonstrate to the audience the need for the presented instruction. The presenter should also connect with the audience to find alignment with the presenter. Brzycki and Dudt (2005) asserted that the training must be attractive to the audience with convenient times and locations, engaging presenters, and creative session titles. Wei et al. (2009) also established that professional development throughout the year during the professional learning community process is beneficial because the teacher learning is brief and can be applied immediately. Planning for the best time and method of offering technology-based professional development is important.

As technology usage increased in society, teachers increased their use of classroom technology, including computers, Chromebooks, laptops, and even personal cell phones. Ally et al. (2014) asserted that teachers need training to design learning materials to use mobile devices effectively, and students need training to determine credible information sources. Teachers also need to adapt to the increasing use of

multimedia materials and less text. As the necessity of remote learning increased due to the COVID-19 shutdown, teacher knowledge and positive perceptions of remote learning methods became critical. Thus, effective technology-based professional development became critical.

Technology-based professional development may influence teacher perceptions of technology, and in the COVID-19 era, professional development was even more critical. Teaching in a blended or remote environment, which means at least partially online, became necessary during the COVID-19 shutdown. Before COVID-19, professional development in blended learning was challenging to implement for some teacher-learners (Ally, Grimus, & Ebner, 2014). Parks, Oliver, and Carson (2017) established that the transfer of professional development into practice is multifaceted. Teachers' inabilities to put learning into practice soon after the professional development session was partially responsible for the lack of implementation. Parks et al. also claimed teachers found the ability to teach in a blended learning environment desirable; however, they found the teachers' actual skills with blended learning novice or emerging. Parks et al. asserted that the most effective professional development for blended learning was individualized to meet teachers' specific needs. Parks et al. also contended that existing professional development did not make a difference in the successful implementation of blended learning. Modeling, however, was an effective method for training teachers and students. Rigorous teacher training programs for pre-service teachers, continued growth opportunities for experienced teachers, and extended learning opportunities for highly effective teachers were recommended for continual professional improvement (Parks et al., 2017). Curriculum directors and administrators may influence teacher perceptions of

technology with careful planning of professional development. The COVID-19 shutdown made clear that offering professional development in technology is ineffective if the skills are not soon transferable to actual daily instruction.

Time is a prevalent issue with professional development. Wright (2017) noted that after-school technology training sessions are more beneficial to teachers than summer sessions. Also, building additional preparation time into teachers' daily schedules to offer teachers time to record lessons or video conferences with students proved a morale booster and a method for increasing technology integration success. Finding time to increase teacher technology knowledge and allow teachers to implement new technology strategies was a challenge that districts across the nation faced. Schaffhauser (2017) surveyed over 2,800 teachers about technology integration. Schaffhauser determined that the most frequently cited barriers to technology integration were the lack of student devices and time to learn and teach new technology methods. In 2020, when the COVID-19 pandemic caused schools worldwide to close, the need to transition to virtual learning caused many districts to learn difficult lessons about what worked and what did not. Ferdig et al. (2020) compiled lessons learned from teachers worldwide during the pandemic. These real-world lessons helped evolve teacher perceptions. One of those stories came from Maria Avgerinou, Director of eLearning at American Community Schools Athens. Avgerinou offered a five-phase process to transition to virtual learning. The five steps included delivering content via videos and presentations, teacher support, student support, assessment and grading, and feedback and critique. Using Avgerinou's five-step process benefits schools struggling with transitioning to distance learning (Ferdig et al., 2020). The changes in education that began during the pandemic may

remain in a post-COVID-19 era. Lessons and strategies found to be effective during COVID-19 positively shaped future distance-learning assignments and influenced changes in education even when the pandemic passed.

To keep teacher perceptions of technology positive, administrators may benefit from professional development in technology. Ugur and Koç (2019) asserted that administrators have accountability for technology implementation in their buildings. District administration may consider first building technology competencies in building administration before implementing a technology initiative. ISTE standards for education leaders assert that leaders will empower teachers to enrich teaching with technology (ISTE, 2021). Demski (2012) quoted Robert Farrace, senior director of communications and development with National Association of Secondary School Principals, “The principal who models these behaviors is going to be able to inspire innovation in their school much more effectively than a principal who simply requires that teachers use technology, or collaborate, or take risks" (p. 49). The principal must guide the school’s culture, and most schools include in their mission statements that they are preparing students to be productive citizens in a 21st-century society. Principals must get everyone involved in the mission of the school and invest in success. Demski (2012) reported seven habits of effective technology leaders. Principals must create an atmosphere that inspires innovation, fosters collaboration, be open to new ideas, be connected learners, locate and provide adequate resources, take risks, and have a visionary focus. For teachers to perceive technology support favorably, districts may effectively utilize all personnel to support all educators in technology initiatives to ensure the initiative’s success and favorable teacher perceptions.

Professional development plays a vital role in teacher perceptions of technology. Hegedus, Trapper, and Dalton (2016) asserted that teachers are more effective after 5 years in the classroom and that instructional technology affects student performance, classroom climate, and teachers' perceptions about learning. Teacher learning of technology was best integrated when technology was part of a broader vision for instruction. Principal support and teacher ability and attitude regarding technology should be part of a broader vision. As the TAM framework supports, actual system usage is influenced by teacher perceptions based on ease of use and perceived usefulness. Therefore, supporting teachers in making technology easy to use and showing teachers how the technology benefits them via professional development will lead to positive perceptions and successful technology implementation.

Teacher Perceptions of Technology: Obstacles to Technology Usage

Barriers to technology integration may influence teacher perceptions of technology. Lack of time to learn new skills is a pervasive barrier when integrating a new technology initiative (Schaffhauser, 2017). Learning new skills takes time, and teachers' time is limited, especially when asked to simultaneously teach multiple modalities, as occurred across Arkansas during the COVID-19 pandemic (Perozek, 2020). Wright (2017) asserted that administrators must build time for teacher learning into the school day and school year. Lack of professional development and infrastructure, like access to the Internet, were also mentioned as obstacles. Administrators may want to consider commonly known barriers to technology usage and prepare to overcome the common barriers. Obstacles to technology usage are numerous and may influence teacher perceptions negatively, but barriers are not insurmountable.

Teacher perceptions of technology may be influenced by criticism from stakeholders throughout the educational community. Critics of technology integration have frequently noted that technology does not lead to student achievement gains despite the significant investment of funds. Weston and Bain (2010) determined that large 1:1 initiatives failed to have statistically significant gains in reading achievement, but the criticism was not only of technology initiatives but educational reform practices in general. Most unsuccessful reform attempts did not emphasize what teachers value, which indicates the importance of positive teacher perceptions in education. Weston and Bain proposed a paradigm shift where stakeholders, including teachers, decide what their schools need. They suggested that implementation and change would only be successful with engagement from multiple stakeholders. Positive perceptions of technology from all stakeholders, including teachers, will influence the likely success of technology initiatives.

Another obstacle influencing teacher perceptions of obstacles to technology usage is resistance. Resistance to new technology has often kept universal adoption from occurring (Lapointe & Rivard, 2005). Some technology resistors believe technology eliminates jobs. Some resist technology because they struggle with change, and other resistors do not find technology useful or necessary. Lapointe and Rivard (2005) asserted that some leaders trying to implement a new technology initiative believe the resistors must be overcome, and others view resistance to new technology as a necessary discomfort during a time of change. Lapointe and Rivard recommended that resistance to technology be viewed neutrally as a natural component of technology change. School leaders may consider technology resistance and acceptance an integral part of adopting

new technology initiatives or expectations. Leaders may consider the TAM: making the technology practical and easy to use to influence positive teacher perceptions of technology, leading to actual technology usage.

Teacher Perceptions of Technology: Technology Support Available

As the TAM framework suggests, one of the keys to positive teacher perceptions of technology and subsequent technology usage is the amount of technology support available to teachers. Available technology support influences ease of use, and ease of use influences positive perceptions, leading to actual technology usage. Increasing available technology support does not have to begin with adding staff or hiring outside professional development presenters. Tucker (2019) discussed that the first step for districts when beginning a technology initiative is generally the purchase of the hardware when the first step should generate a spark of excitement in teachers for the initiative. Lee and Min (2017) also discussed the need for teacher consensus or acceptance of new initiatives. Tucker asserted that teachers learning together in professional learning communities effectively support teachers in technology implementation. School leaders will want to examine their existing faculty to determine if other roles could potentially support teachers.

Just as every district is different, so are the solutions for providing technology help for teachers. Instructional technology teams have been tasked with supporting teachers with the software they are unfamiliar with and supporting families with Chromebooks and hotspots (Castelo, 2020). Castelo (2020) suggested that a tech support help desk add automation and self-help portals to improve efficiency. While hiring additional technology personnel to support teachers is one solution, financial constraints

often make that solution difficult. Ballew (2017) suggested that less experienced teachers be paired with experienced teachers as mentors, with the teacher with more experience in technology taking on the mentoring role. The methods of supporting teachers in technology are numerous, and each district should thoughtfully consider their personnel to plan for the challenges associated with remote learning. With the TAM, perceived ease of use will influence teacher perceptions leading to technology usage.

As schools provide technology support to teachers, various roles should be considered as possible sources of support. Ugur and Koç (2019) suggested that principals and administrators serve as technology leaders in their buildings. To evaluate teachers in their buildings, administrators should know how to use the teachers' technology. As technology increases and the integration of technology in the classroom evolves, administrative support is crucial to successful implementation. As the buildings' instructional leaders, principals need a clear vision of supporting teachers in finding technology valuable and easy to use to influence teacher perceptions because positive perceptions will lead to actual technology usage according to the TAM framework.

Possible Teacher Demographics Affecting Teacher Perceptions of Technology

Years of Experience

An important factor in teacher perceptions of technology in the classroom is the teachers' background knowledge. Peng and Wong (2018) investigated how teachers' backgrounds affected teachers' educational philosophies and computer usage in the classroom. They established that teachers with over 6 years of teaching experience had more positive attitudes toward technology usage. They also determined that teachers with bachelor's degrees and more than 26 years of experience had a lower computer usage

level in the classroom. Ballew (2017) revealed similar results and suggested that less experienced teachers pair with experienced teachers as mentors, with the teacher with more experience in technology taking on the mentoring role. Ballew reported that more experienced teachers did not have relevant technology training during their teacher preparation programs. In contrast, Gorder (2008) did not find differences in technology usage based on years of experience. Instead, he asserted that grade-level teaching assignment and personal characteristics were more influential than years of experience. The factors which influence technology usage can be related to the TAM model—the perceived usefulness of the product may vary based on teacher characteristics. The TAM would allow for differences in usage based on perceived usefulness and ease of use.

Studies of teacher age as a predictor of technology usage have contradictory results. Kilicer et al. (2018) studied age as a predictor of teacher usage of technology. Even in teachers who grew up with the Internet, age may play a role in technology acceptance for some teachers, but a great deal of variance can be established. Kilicer et al. referred to people who grew up with the Internet as *digital natives*. Technology usage is a firmly entrenched part of daily living for those considered digital natives, but a wide variance in technology usage can be found even within that age range. Teo (2014), who studied teacher perceptions relating to the TAM, determined that teachers with fewer than 7 years of experience found technology easier to use, and teachers with more years of experience were more familiar with integrating technology into their teaching practices. As Teo and the TAM framework would support, school leaders should carefully consider the ease-of-use and perceived usefulness of a product before investing in a program or

initiative that is difficult for their current staff. This careful consideration will lead to improved perceptions, leading to actual technology usage.

Grade Level

Another significant factor in teacher perceptions of technology is the grade-level teaching assignment. Gorder (2008) studied multiple factors influencing teacher technology perceptions and found that grade-level teaching assignment was the most significant. Teachers in Grades 9-12 were more likely to use technology in the classrooms and their homes. Ballew (2017) found that secondary teachers were more likely to have positive perceptions of technology and use technology in their classrooms than elementary teachers. Ballew suggested that secondary teachers mainly utilized platforms such as Google Classroom more than elementary teachers. Gorder (2008) found teacher perceptions were influenced by teacher demographics such as subject and grade-level teaching assignment because some grade levels and subjects could more easily integrate technology. Teo (2014), who studied teacher perceptions concerning the TAM, determined that elementary teachers rated themselves higher than secondary teachers on technology perceptions. However, his research indicated no significant differences between elementary and secondary teachers' perceptions of the technology. The difference in how teachers perceive their acceptance of technology and their actual acceptance of technology is interesting. How teacher perceptions of technology are influenced by grade-level teaching assignment and years of experience will prove insightful to school leaders.

Other factors may influence teacher perceptions of technology. Williams et al. (2000) did not find grade-level teaching assignment as crucial as teacher attitude. When

teachers saw the benefits of technology implementation for themselves, their students used technology more often. However, when teachers experienced problems and difficulties using technology, they tended to perceive technology negatively and use technology less frequently because the difficulties and mishaps seemed to outweigh the benefits. However, Williams et al. (2000) did report that perceptions regarding technology varied among secondary teachers in different subject areas, and secondary teachers who taught mathematics or science had a more negative perception of technology. Those who taught business courses had a more positive perception. Other researchers have also studied teacher perceptions of technology. Kearney et al. (2018) asserted that elementary teachers used technology in diverse ways for student engagement, whereas secondary teachers used technology more for teacher presentations. The ways technology is implemented in classrooms varies widely from teacher to teacher, but possible differences in perceptions can be found between elementary and secondary teachers. Grade-level teaching assignment may influence teacher perceptions of technology.

Additional teacher demographics may also influence teacher perceptions. Gorder (2008) and Yidana (2007) asserted that high school teachers found technology more useful than elementary teachers. When considering the TAM framework, perceived usefulness would influence perception and intent to use. Blackwell et al. (2014) suggested that teacher perceptions towards technology and socioeconomic status of the school have the most substantial impact on teacher usage of technology. Wright (2017) confirmed that individual teacher's personal technology integration was strongly associated with teacher perceptions of technology. As classrooms changed to incorporate

additional devices, additional web-based learning programs, interactive Smartboards, and learning management systems, new technology skills became necessary for teachers. Teacher perceptions are evolving as rapidly as technology evolves, and the requirement to incorporate technology into classrooms increases, especially due to the COVID-19 shutdown.

Coronavirus Disease 19 Shutdown Implications on Teacher Perceptions

During the COVID-19 shutdown, teachers had to adapt to an environment that changed almost overnight. When the United States shut down onsite instruction in March of 2020, many schools were unprepared to offer remote learning. Paper packets of review worksheets were often sent home because families and communities did not have devices and available Wi-Fi to support technology-based remote learning. Technology was needed, and in many communities, access to the Internet was not readily available. Student learning could not be sacrificed indefinitely for public health; however, schools were required to develop a plan to meet students' needs even when onsite instruction was suspended (ADE Data Center, 2021b). In Arkansas, districts formed Ready for Learning teams to develop plans for reopening and providing instruction to onsite and virtual students. Ready for Learning teams included teachers planning for reopening schools, which likely increased positive teacher perceptions of the plans.

During the summer of 2020, state educational agencies developed policies regarding the reopening of schools. In Arkansas, the Division of Elementary and Secondary Education required districts to develop a plan to allow students to return to school onsite five days a week, with a virtual option available to students (Perozek, 2020). Some districts were better prepared than others to offer learning in two modalities

because of previous technology investments. Several districts were already one-to-one (1:1) with devices, and time will reveal if teachers in 1:1 districts more easily faced the challenges of the 2020 shutdown. The knowledge that a digital divide or lack of equity in technology access exists in student homes and from community to community has already been well established (Perozek, 2020). When schools reopened, common obstacles experienced with remote learning revolved around lack of devices, Internet access, and infrastructure (Turner-Lee, 2020). Teaching onsite and remotely led to overwhelmed educators and technology departments (Perozek, 2020). Districts attempted to support teachers during this challenging time. Supporting teachers with increased professional development in technology instruction was one method that may have led to positive perceptions.

As teaching changed during the pandemic with increased devices and opportunities to use technology, what teachers were required to do to meet the needs of students changed, which may have influenced teacher perceptions. Incessant innovation can be exhausting financially and mentally, and during the COVID-19 shutdowns and pivoting to virtual learning, innovation from teachers became commonplace. Carver (2016) asserted that lack of availability of technology was the most significant barrier to technology usage. So, the COVID-19 shutdown of schools for onsite learning and the associated increased number of devices and digital learning platforms may have increased positive teacher perceptions of technology. Teachers' experiences and requirements changed with the pivot to remote learning, and their perceptions of technology may have as well. O'Regan (2020) indicated that the availability of support and instruction in new technology was crucial for positive perceptions of technology.

School leaders will want to ensure teachers have the support they need after the COVID-19 pandemic.

The increased integration of technology brought about other changes beyond the addition of software and hardware. Teachers were required to give assessments remotely. Assessments were implemented, reflecting the change in pedagogical practice during remote learning (Hoffman & Ramirez, 2018). The ability to find information online will make assessments of rote memory facts unnecessary, and online assessments will increase. Before the pandemic, Hoffman and Ramirez (2018) suggested designing assessments using technology like Quizlet, Plickers, and Kahoot! to make classes more engaging. The ability to teach and assess students in an engaging way with technology is likely to make teachers view technology in a positive light; however, the constant need to learn new technologies to assess students may also play a role in teacher perceptions.

Because of the COVID-19 shutdown, once predominantly higher-education practices, such as blended learning, were found in secondary classrooms. Although the definition has evolved, one unchanging component of blended learning is offering instruction in multiple modalities (Longo, 2016). Longo (2016) described blended learning as a combination of onsite and remote instruction, including the usage of web-based platforms, various pedagogical approaches, and a combination of instruction and tasks. Blended learning became widespread during the pandemic as teachers frequently had to teach remotely and teach onsite (Perozek, 2020). Blended learning may not have begun during the COVID-19 pandemic, but the pandemic may have ensured blended learning's permanent place in education. As the TAM framework asserts, usefulness and ease of use of technology will lead to positive teacher perceptions, which will lead to

actual technology usage. Therefore, as technology evolves to make teachers' jobs more manageable in the pandemic, teachers will increasingly perceive technology positively and use technology.

Summary

An adage states that nothing is permanent except change. Ferdig et al. (2020) asserted that the pandemic has shaped the way education will look forever. Teacher usage of technology was no longer optional, and teacher perceptions of technology affected their abilities to pivot to remote teaching. The more frequently teachers used computers in their classrooms, the more positive the teachers' perceptions toward technology. Peng and Wong (2018) revealed that computer-assisted instruction showed small but positive effects compared to traditional instruction without technology. When teachers saw the positive effects of using computers, they tended to use computers more frequently. Peng and Wong suggested that schools support teacher knowledge regarding software and hardware, increase the educational budget, hold professional development workshops for teachers, and offer teachers training courses and websites. Peng and Wong recommended increasing professional development, requiring teachers to use technology to exchange information with other teachers, and advocating for computer-assisted teaching's convenience and benefits. Foulger, Graziano, Schmidt-Crawford, and Slykhuis (2017) stated that teacher preparation programs need to prepare future teachers for technology's core competencies. As Lee and Min (2017) and Tucker (2019) concluded, positive teacher perceptions are necessary for technology initiatives' success. As the TAM framework indicates, technology ease of use is necessary for technology adoption. So, administrators must support teachers in gaining this knowledge. Various strategies for

supporting teachers in increasing positive perceptions of technology can be applied to meet this need besides hiring additional technology personnel.

To support teachers in delivering remote or blended instruction, schools must also consider the technology tools available to create engaging instruction for remote learners. Even before the COVID-19 shutdown, critics of virtual education cited low student engagement (Tucker, 2012). Molnar et al. (2019) suggested that virtual learning cannot continue without sanctions and close supervision. Molnar et al. cited an example of a parent of an elementary student remote learning as Pavlovian. Students complete online worksheets and receive animation or a sound effect as a reward for completion, with little individualized attention. Finding creative ways to support teachers while implementing engaging remote learning is imperative for positive teacher perceptions of technology.

Carefully considering methods and personnel to support teachers with technology will be necessary for schools going forward. Increasing numbers of Chromebooks and hotspots sent home with families unfamiliar with the devices will increase the need for technology support (Castelo, 2020). Castelo (2020) also advocated creating self-help portals and automated systems to deal with frequent technology issues. Help centers for all stakeholders are encouraged, allowing other personnel to support teachers in unfamiliar areas such as video conferencing and posting videos online. Districts must thoughtfully prepare for technology usage, and purchases without teacher preparation will not be as effective. Teachers have the most crucial role in instructional technology implementation. The more preparation technology initiatives are given, and teachers realize the more effects and advantages, the more likely the teachers could positively perceive technology and use technology in the classroom. The literature review suggested

that teachers' perceptions of technology are complex and influenced by various factors. This study seeks to investigate if grade-level teaching assignment and years of teaching experience influence teacher perceptions of comfort with technology, teacher perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, and teacher perceptions of technology support available. In Chapter III, the research design for each hypothesis was described. The districts' demographics, the survey construction, and the study's methodology was explained.

CHAPTER III

METHODOLOGY

The review of the literature suggested that several factors influence teacher perceptions of technology. What is unknown is whether teaching during the COVID-19 pandemic also influenced teacher perceptions. The TAM framework would suggest that the perceived usefulness of the product would influence teacher usage and overall perception of technology. Therefore, pandemic-era teaching may have influenced teacher perceptions because of technology's ability to allow teaching to continue during the pandemic. Teaching during this unprecedented time required heavy technology usage, often with unfamiliar applications and learning management systems. Videoconferencing replaced face-to-face instruction, and interactions between teachers and students were filtered through computers. How these changes affected teacher perceptions of technology has not yet been explored.

Guiding this research is whether years of experience and grade-level teaching assignment affect teacher perceptions of technology. A literature review revealed mixed findings related to these variables. Ballew (2017) suggested that teachers with high levels of experience were less likely to have received training in technology during their teacher preparation programs, thus influencing their comfort with technology. Peng and Wong (2018) also determined that years of experience influenced teacher perceptions of technology, but Gorder (2008) asserted that years of experience were less influential than

grade-level teaching assignment and teachers' personal characteristics. The review also revealed mixed results regarding whether differences would exist between elementary and secondary teachers in perceptions of technology. Gorder (2008) and Yidana (2007) determined secondary teachers used technology more often than elementary teachers and were more comfortable with technology. Blackwell et al. (2014) and Wright (2017) suggested that the socioeconomic status of the school and the teacher's personal technology habits were more influential than grade-level teaching assignment. This study was conducted to examine further these two independent variables' effect on teacher perceptions of technology. This chapter includes the research design, the sample of teachers, the instrument, the analytical methods used, and the study's limitations.

Research Design

A quantitative, causal-comparative design was used. According to Mills and Gay (2019), a causal-comparative design may be used when the behavior is pre-existing, when the independent variables cannot be manipulated, and when attempting to determine the cause for pre-existing differences in the groups. The design began as a between-groups, factorial design. The independent variables for the original hypotheses were grade-level teaching assignment (Elementary = K-5 versus Secondary = 6-12) and years of experience (Novice = 0-3 years of experience versus Experienced = 4+ years of experience). The dependent variables were teacher perceptions of comfort with technology, teacher perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, and teacher perceptions of technology support available. However, soon after the survey was launched, the responses revealed that novice teacher responses (n = 72) were not comparable to experienced teacher

responses (n = 175). Because of the low number of novice teacher responses, the design was changed to broaden the definition of novice teachers to include those teaching in their first 5 years and include eight single-factor statements using independent sample *t*-tests for the analyses. This design included four independent sample *t*-tests for grade-level teaching assignment and four independent sample *t*-tests for years of experience. The new hypotheses follow.

1. No significant difference will exist between teachers in Grades K-5 versus Grades 6-12 on teacher perceptions of comfort with technology measured by a modified survey combining items from the USEIT survey and the PETI survey for teachers in six school districts in Central Arkansas.
2. No significant difference will exist between teachers in Grades K-5 versus Grades 6-12 on teacher perceptions of technology-based professional development measured by a modified survey combining items from the USEIT teacher survey and the PETI survey for teachers in six school districts in Central Arkansas.
3. No significant difference will exist between teachers in Grades K-5 versus Grades 6-12 on teacher perceptions of obstacles to technology usage measured by a modified survey combining items from the USEIT teacher survey and the PETI survey for teachers in six school districts in Central Arkansas.
4. No significant difference will exist between teachers in Grades K-5 versus Grades 6-12 on teacher perceptions of technology support available measured by a modified survey combining items from the USEIT teacher survey and the PETI survey for teachers in six school districts in Central Arkansas.

5. No significant difference will exist between 0-5 years of teaching experience versus 6+ years of experience on teacher perceptions of comfort with technology measured by a modified survey combining items from the USEIT survey and the PETI survey for teachers in six school districts in Central Arkansas.
6. No significant difference will exist between 0-5 years of teaching experience versus 6+ years of experience on teacher perceptions of technology-based professional development measured by a modified survey combining items from the USEIT teacher survey and the PETI survey for teachers in six school districts in Central Arkansas.
7. No significant difference will exist between 0-5 years of teaching experience versus 6+ years of experience on teacher perceptions of obstacles to technology usage measured by a modified survey combining items from the USEIT teacher survey and the PETI survey for teachers in six school districts in Central Arkansas.
8. No significant difference will exist between 0-5 years of teaching experience versus 6+ years of experience on teacher perceptions of technology support available measured by a modified survey combining items from the USEIT teacher survey and the PETI survey for teachers in six school districts in Central Arkansas.

Sample

Data were obtained from participants who took a voluntary survey to test the eight hypotheses. The survey introduction explained the voluntary and anonymous design of

the survey. The survey was then sent electronically through a Google Form to K-12 teachers in six Central Arkansas public school districts in the spring of 2021. The survey was emailed to the district superintendents, who distributed the survey to their faculty. Two of the districts were considered large (7A and 6A), and four were considered medium-sized (4A and 5A), as classified by the Arkansas Activities Association (2021). The districts ranged from 35% free and reduced lunch eligibility to 100% free and reduced lunch eligibility. Three districts had 35% - 42% free and reduced lunch eligibility, two were slightly over 50% free and reduced lunch eligibility, and one was 100% free and reduced lunch eligibility (ADE Data Center, 2021a). Table 1 includes the teacher responses by experience and grade-level teaching assignment.

Table 1

Respondents to Survey by Experience and Grade-Level Teaching Assignment

	Novice (1-5)	Experienced (6+)	Teaching Level Total
Elementary (K-5)	37	72	109
Secondary (6-12)	36	95	131
Experience Total	73	167	240

The survey elicited 258 responses; 18 responses were not counted because the respondents were not teachers or could not be classified as elementary or secondary.

Instrumentation

The primary instrument was modified from two existing surveys: the USEIT teacher survey, developed by Boston College (Russell et al., 2003), and the PETI teacher survey developed by the SETDA (2004a, 2004b). The original USEIT instrument captured teacher perceptions of technology through 46 multi-part questions, and the PETI survey captured teacher perceptions through 55 multi-part questions. The modified instrument consisted of 35 items, including two questions related to years of teaching experience and grade-level teaching assignment. The survey asked teachers to select their grade-level teaching assignment from a drop-down list. Teachers responded to a question asking what grade/s they currently teach. Teacher responses were subsequently categorized as elementary (K-5) or secondary (6-12). Some responses were deleted due to items that did not allow a designation of either elementary or secondary; for example, teachers who taught all grade levels. Teachers also responded to a question asking about their years of teaching experience. In the beginning stages of this analysis, teachers were categorized as novice if they responded they were in their first 3 years of teaching. Teachers with four or more years of experience were categorized as experienced. After the responses were collected, the lack of novice responses, along with information gleaned from the literature review, caused this researcher to categorize novice teachers as those in their first five years of teaching, and teachers with more than five years of experience were categorized as experienced. The survey's other 33 questions were divided into four constructs: teacher perceptions of comfort with technology (6 questions), teacher perceptions of technology-based professional development (7 questions), teacher perceptions of obstacles to technology usage (10 questions), and

teacher perceptions of technology support available (10 questions). Each respondent completed questions on a 4-point Likert scale ranging from strongly disagree (score of 1) to strongly agree (score of 4) on the digital survey constructed with Google Forms.

Teacher perceptions of comfort with technology were addressed with six items. Williams et al. (2000) concluded that teachers are the most important agents of technology implementation and that their comfort with technology plays an integral role in how they perceive technology. Atabek (2020) determined that teacher anxiety surrounding technology may lead to feelings of inadequacy and depression. Even digital natives vary in their comfort levels with technology (Kilicer et al., 2018). Teachers responded to the six items under this category with a 1-4 on a Likert scale. Thus, a score of 24 indicated the highest level of teacher comfort with technology. The lowest possible score of 6 indicated the lowest level of teacher comfort with technology.

Teacher perceptions of technology-based professional development were also examined. Brzycki and Dudt (2005) asserted that technology-based professional development must be engaging, attractive, and convenient for teachers. Wei et al. (2009) suggested that professional development should be presented throughout the school year in short sessions, and Parks et al. (2017) contended that technology-based professional learning should be as individualized as possible. Technology-based professional development was addressed with seven items on a 1-4 Likert scale. The highest possible score of 28 would indicate teachers perceived the technology-based professional development as relevant to what they needed to use technology proficiently. The lowest possible score of 7 would indicate teachers did not perceive the technology-based professional development as relevant to what they needed to use technology proficiently.

Teacher perceptions of obstacles to technology usage were also examined. Schaffhauser (2017) concluded that lack of time to learn new technology skills is a significant obstacle for teachers. Weston and Bain (2010) determined that school leaders must give teachers and other stakeholders a voice in technology initiatives, influencing teacher perceptions. In the teacher perceptions of obstacles to technology usage category, ten items used a 1–4 Likert scale. The highest possible score of 40 would mean teachers perceived they encountered significant obstacles to technology usage. The lowest possible score of 10 would indicate teachers did not perceive they encountered significant obstacles to technology usage. A high score would not be a positive sign for districts in this category, whereas a high score in the other categories would.

As in the previous category, teacher acceptance is important to teacher perceptions of technology support available. Lee and Min (2017) discussed the need for teachers to support technology initiatives on the front end of a technology purchase. Castelo (2020) offered suggestions for automated technology support, especially during a pandemic, and Ballew (2017) suggested a mentoring program for technology support. Ugur and Koc (2019) asserted that building leaders should support teachers in technology usage. This category was tested with 10 items on a 1–4 Likert scale. The highest possible score of 40 would indicate teachers perceived technology support as sufficient. The lowest possible score of 10 would indicate teachers did not perceive technology support as sufficient.

Permission to modify the USEIT teacher survey was granted in October 2020 via email. Permission for the PETI survey was granted with visible acknowledgment of the source. Reliability for the USEIT teacher survey is .75 using Cohen's Kappas (Russell et

al., 2003), and reliability for the PETI survey was reported as generally high using KR-20 by Nordstrom (2003).

Data Collection Procedures

Permission was sought from district superintendents of six Central Arkansas districts. The superintendents granted written permission, and the Institution Review Board approved the study in March 2021. The Google Form survey link was emailed to the superintendents who shared the survey with their staff via email in the spring semester of 2021. A 2-week window for response collection was initially given, but the window was extended to collect more novice teacher responses. The data collection ended in June. The introduction to the survey informed teachers that all responses were voluntary and anonymous. All information obtained was password protected. The responses were sorted by teachers' years of experience and grade-level teaching assignment before tests were performed on the data. The response spreadsheet was then exported to *IBM Statistical Packages for the Social Sciences (SPSS) Version 26* for analysis.

Analytical Methods

Data were analyzed statistically using *IBM SPSS Version 26* (Leech et al., 2015). Each of the eight hypotheses was analyzed with an independent samples *t*-test, and a two-tailed test with a .05 level of significance was used for statistical analysis. Data were examined to verify that the assumptions were met for the test of significance, and missing data were found before running the statistical tests (Leech et al., 2015). Eight independent samples *t*-tests were conducted to address the hypotheses using teacher years of experience (Novice = 0-5 years of experience and Experienced = 6+ years of experience)

and grade-level teaching assignment (Elementary = K-5 and Secondary = 6-12) as the independent variables. The dependent variables were teacher perceptions of comfort with technology, teacher perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, and teacher perceptions of technology support available. The following codes were used for each independent variable: years of experience (1 = Novice, 2 = Experienced) and grade-level teaching assignment (1=Elementary, 2 = Secondary). The assumptions of independent observations, homogeneity of variances, and normal distributions of the dependent variable for each group were checked.

Limitations

This study contained some limitations, and those limitations should be considered to evaluate internal and external validity. One limitation was that the survey was not deployed to the same group of teachers before the pandemic. Prepandemic data would have helped compare the before and after-effects of the pandemic on teacher perceptions of technology based on teacher comfort level with technology, teacher perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, and teacher perceptions of technology support available. The lack of pre-assessment data does not allow the researcher to determine any causal relationship between the pandemic and teacher perceptions of technology (Choueiry, 2021). The pandemic's effect on education is unquestioned, but its effect on teacher perceptions of technology remains unknown.

Another limitation was the lack of novice teacher responses compared to experienced teacher responses. The number of teachers in the sample with 6 or more

years of experience outweighed the number of teachers with 5 or fewer years of experience in these six Central Arkansas districts and across the state (ADE Data Center, 2021a). The average years of teaching experience in Arkansas are 11.82 years (ADE Data Center, 2021a). Independent samples *t*-tests require the assumption of normality; in this study, the independent variables were not normally distributed, as there were more experienced teacher responses than novice teacher responses, so the responses were skewed. This is a violation of the assumption of normality (Van der Berg, 2021). To get an equal number of novice and experienced teacher responses, an equal sample from each population may need to be used in future studies.

The sample came from a geographically homogenous group of teachers. All of the districts were located in Central Arkansas. Because the survey responses were voluntary, this sample was considered a sample of convenience, which may be considered a limitation. A sample of convenience limits the generalizability of these results (Glen, 2021). If random sampling was used, the results could be generalized to a larger population. Additionally, the assumption is that all responses were honest and that participants understood the question being asked. The teachers were aware that the survey was anonymous and voluntary, and each respondent had the opportunity to indicate that he or she was not a certified teacher with a choice that said, "I am not a teacher."

The distribution of the survey was somewhat unreliable. Superintendents may have sent the survey to principals who may not have distributed the survey. The survey could have been distributed to staff members who were not certified teachers but who may have responded that they were. Additionally, the administrators distributing the

survey could have influenced participant responses. However, procedures were put into place to avoid as much bias as possible. Despite these possible limitations, valuable information can be gleaned from this study.

Summary

Teacher technology usage is influenced by teacher perceptions of the ease of use of the technology product and perceived usefulness of the product, as the TAM indicates (Davis, 1987). During the COVID-19 pandemic, technology was helpful and necessary for education to continue. How teachers' perceptions of technology may have evolved during the COVID-19 pandemic is unknown, but this research examined if the years of experience and teaching level affected teacher perceptions of technology. Chapter IV will provide the study's statistical results.

CHAPTER IV

RESULTS

First, the purpose of this study was to determine if years of experience or grade-level teaching assignment have any effect on teacher perceptions of comfort with technology, teacher perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, or teacher perceptions of technology support available in six central Arkansas school districts. The independent variables were grade-level teaching assignment (Elementary = K-5 versus Secondary = 6-12) and years of experience (Novice = 0-5 years of experience versus Experienced = 6+ years of experience), and the dependent variables were teacher perceptions of comfort with technology, teacher perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, and teacher perceptions of technology support available. The study was conducted when the COVID-19 global pandemic created the necessity of technology usage in education.

The assumptions of independent observations, homogeneity of variances, and normal distributions of the dependent variable for each group were checked. The study's design was such that the assumption of independent observations was met; no subject contributed scores in more than one group. Levene’s tests were also run on each hypothesis to test the homogeneity of variances.

Hypothesis 1

Hypothesis 1 stated no significant difference will exist between teachers in Grades K-5 versus Grades 6-12 on teacher perceptions of comfort with technology measured by a modified survey combining items from the USEIT survey and the PETI survey for teachers in six school districts in Central Arkansas. The assumptions of independent observations, normal distributions of the dependent variable for each group, and homogeneity of variances were checked. The design was such that the assumption of independent observations was met; no subject contributed scores in more than one group. The Shapiro-Wilk test for normality indicated that the assumption of normality was violated: Elementary, $W(109) = 0.90$, $p < .001$; Secondary, $W(131) = 0.85$, $p < .001$. Both groups were negatively skewed. Although this abnormality existed within the data, the *t-test* was robust to violations of normality, especially when both groups were skewed in the same direction (Leech, Barrett, & Morgan, 2015). No extreme outliers were present. Levene's test, $F(238) = 1.47$, $p = .226$, indicated that homogeneity of variances was not violated, and the assumption was met. See Table 2 for the means, standard deviations, and *t*-test results.

Table 2

*Comparison of K-5 Elementary (*n = *109) and Grades 6-12 Secondary (*n =*131) Teacher Perceptions of Comfort with Technology*

Variable	*M*	*SD*	*t*	*df*	*p*	*d*
Comfort			0.13	238	.899	0.02
Elem	20.21	3.07				
Sec	20.15	3.77				

Note. Comfort = Teacher Perceptions of Comfort with Technology; Elem = Elementary; Sec = Secondary.

Results of the independent samples *t*-test showed no statistically significant difference between the groups, $t(238) = 0.13$, $p = .899$. See Figure 2 for means of teacher perceptions of comfort with technology of elementary and secondary teachers.

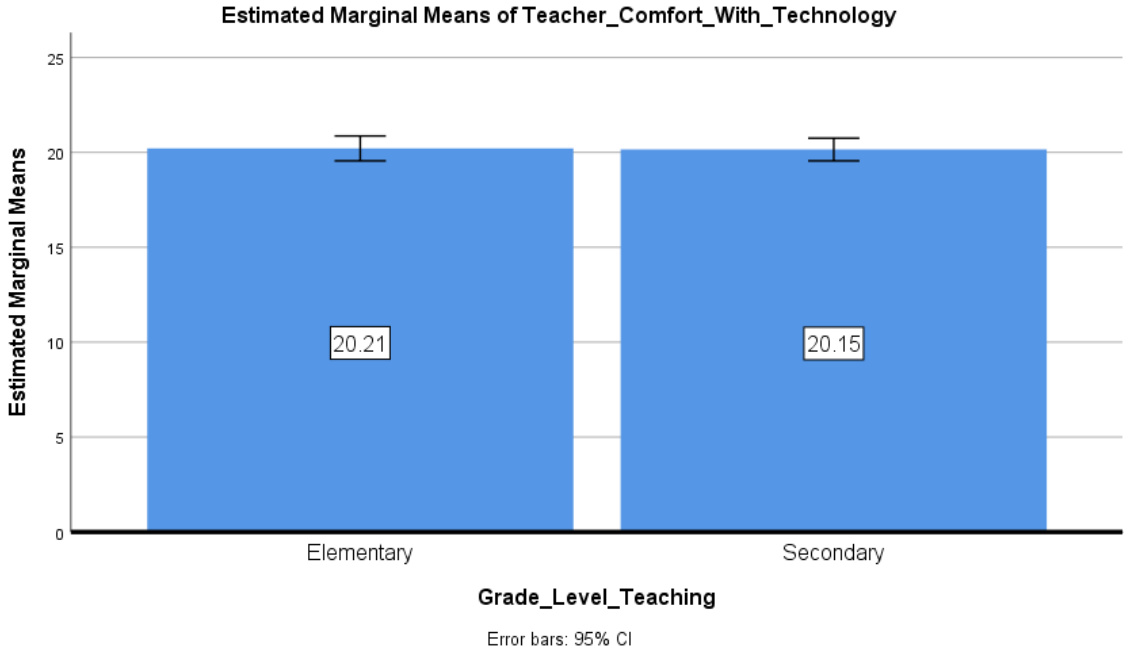

Figure 2. Means of K-5 elementary and Grades 6-12 secondary teacher perceptions of comfort with technology.

The mean of the comfort scores of elementary teachers ($M = 20.21$, $SD = 3.07$) was not significantly different from that of secondary teachers ($M = 20.15$, $SD = 3.77$). The effect size, $d = 0.02$, was small (Leech et al., 2015). Therefore, the null hypothesis was retained.

Hypothesis 2

Hypothesis 2 stated that no significant difference will exist between teachers in Grades K-5 versus Grades 6-12 on teacher perceptions of technology-based professional development measured by a modified survey combining items from the USEIT teacher survey and the PETI survey for teachers in six school districts in Central Arkansas. The assumptions of independent observations, normal distributions of the dependent variable for each group, and homogeneity of variances were checked. The design was such that

the assumption of independent observations was met; no subject contributed scores in more than one group. The Shapiro-Wilk test for normality indicated that the assumption of normality was violated; Elementary, $W(109) = 0.97$, $p = .020$; Secondary, $W(131) = 0.96$, $p = .001$. Both groups were negatively skewed. Although this abnormality existed within the data, the *t*-test was robust to violations of normality, especially when both groups were skewed in the same direction (Leech et al., 2020). No extreme outliers were present. Levene's test, $F(238) = 0.04$, $p = .834$, indicated that homogeneity of variances was not violated, and the assumption was met. See Table 3 for the means, standard deviations, and *t* results.

Table 3

*Comparison of K-5 Elementary (*n *= 109) and Grades 6-12 Secondary (*n *=131) Teacher Perceptions of Technology-Based Professional Development*

Variable	*M*	*SD*	*t*	*df*	*p*	*d*
Prof Dev			0.68	238	.499	0.09
Elem	19.35	4.37				
Sec	18.95	4.74				

Note. Prof Dev = Teacher Perceptions of Technology-Based Professional Development; Elem = Elementary; Sec = Secondary.

Results of the independent samples *t*-test showed no statistically significant difference between the groups, $t(238) = 0.68$, $p = .499$. See Figure 3 for means of teacher

perceptions of technology-based professional development of elementary and secondary teachers.

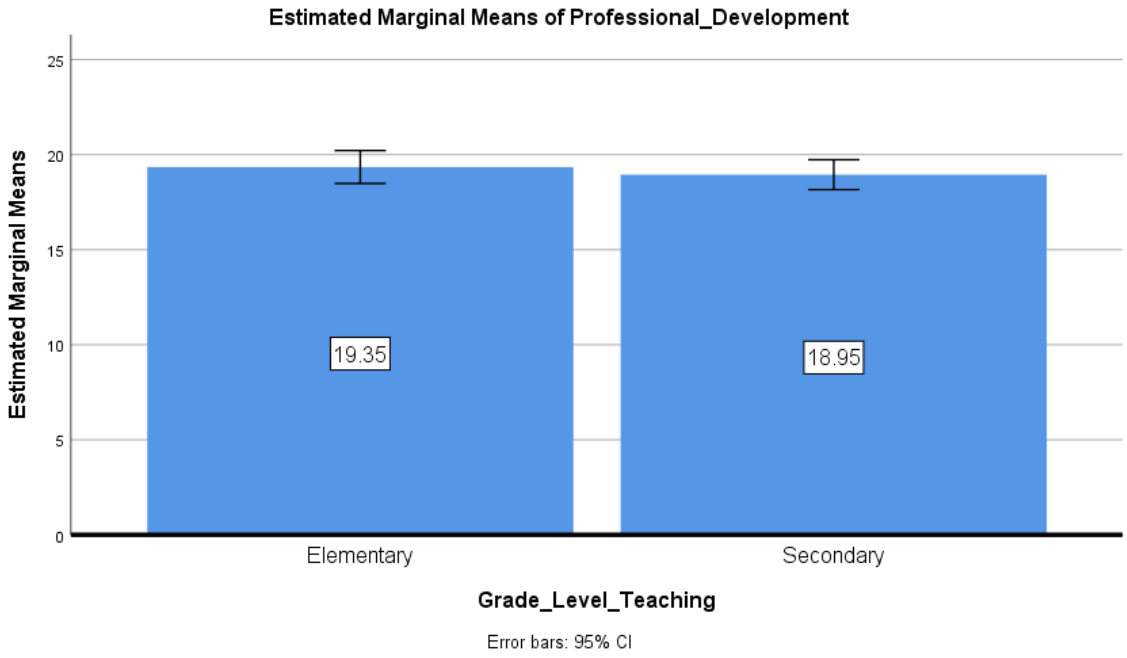

Figure 3. Means of elementary and secondary teacher perceptions of technology-based professional development.

The mean of the teacher perceptions of technology-based professional development scores of elementary teachers (M = 19.35, SD = 4.37) was not significantly different from that of secondary teachers (M = 18.95, SD = 4.77). The effect size, d = 0.09, was medium (Leech et al., 2015). Therefore, the null hypothesis was retained.

Hypothesis 3

Hypothesis 3 stated that no significant difference will exist between teachers in Grades K-5 versus Grades 6-12 on teacher perceptions of obstacles to technology usage measured by a modified survey combining items from the USEIT teacher survey and the

PETI survey for teachers in six school districts in Central Arkansas. The assumptions of independent observations, normal distributions of the dependent variable for each group, and homogeneity of variances were checked. The study's design was such that the assumption of independent observations was met; no subject contributed scores in more than one group. The Shapiro-Wilk test for normality indicated that the assumption of normality was not violated; Elementary, $W(109) = 0.99$, $p = .261$; Secondary, $W(131) = 0.99$, $p = .361$). No extreme outliers were present. Levene's test, $F(238) = 2.24$, $p = .136$, indicated that homogeneity of variances was not violated, and the assumption was met. See Table 4 for the means, standard deviations, and *t* results.

Table 4

*Comparison of K-5 Elementary (*n *= 109) and Grades 6-12 Secondary (n =131) Teacher Perceptions of Obstacles to Technology Usage*

Variable	*M*	*SD*	*t*	*df*	*p*	*d*
Obstacles			1.85	238	.066	0.24
Elem	23.17	4.94				
Sec	21.96	5.13				

Note. Obstacles = Teacher Perceptions of Obstacles to Technology Usage; Elem = Elementary; Sec = Secondary.

The independent samples *t*-test results showed no statistically significant difference between the groups, $t(238) = 1.85$, $p = .066$. See Figure 4 for means of teacher perceptions of obstacles to technology usage of elementary and secondary teachers.

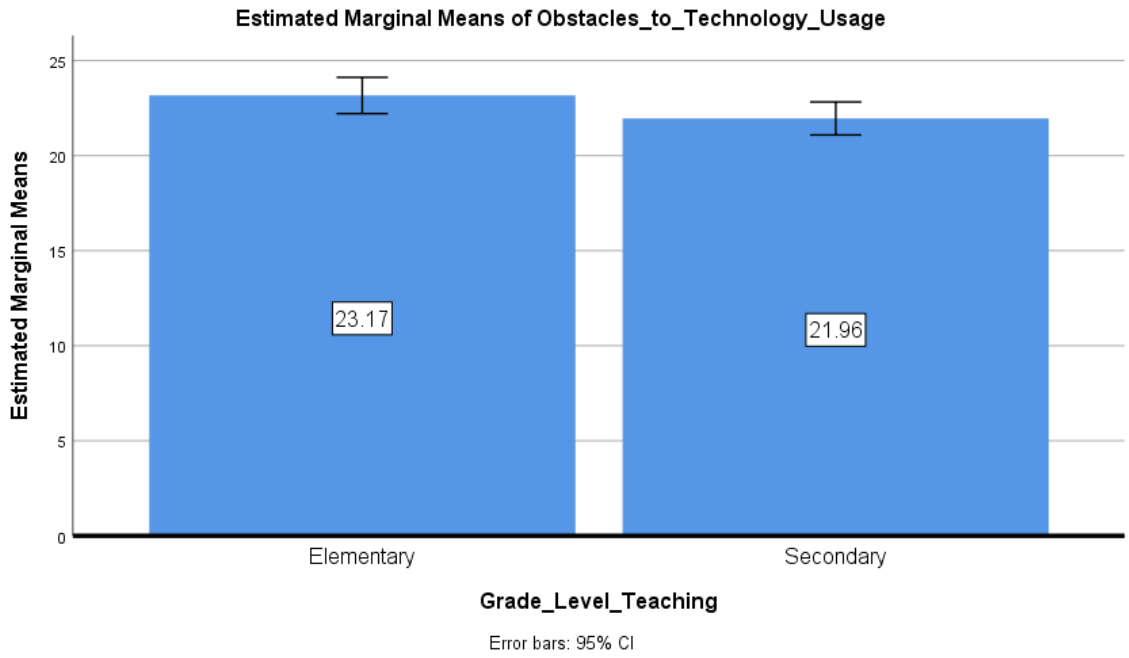

Figure 4. Means of elementary and secondary teacher perceptions of obstacles to technology.

The mean of the teacher perception of obstacles to technology usage scores of elementary teachers ($M = 23.17$, $SD = 4.94$) was not significantly different from that of secondary teachers ($M = 21.96$, $SD = 5.13$). The effect size, $d = 0.24$, was large (Leech et al., 2015). Therefore, the null hypothesis was retained.

Hypothesis 4

Hypothesis 4 stated that no significant difference will exist between teachers in Grades K-5 versus Grades 6-12 on teacher perceptions of technology support available measured by a modified survey combining items from the USEIT teacher survey and the PETI survey for teachers in six school districts in Central Arkansas. The assumptions of independent observations, normal distributions of the dependent variable for each group,

and homogeneity of variances were checked. The design of the study was such that the assumption of independent observations was met; no subject contributed scores in more than one group. The Shapiro-Wilk test for normality indicated that the assumption of normality was violated; Elementary, $W(109) = 0.94$, $p < .001$; Secondary, $W(131) = 0.94$, $p < .001$. Both groups were negatively skewed. Although this abnormality existed within the data, the *t*-test was robust to violations of normality, especially when both groups were skewed in the same direction (Leech et al., 2020). No extreme outliers were present. Levene's test, $F(238) = 2.24$, $p = .136$, indicated that homogeneity of variances was not violated, and the assumption was met. See Table 5 for the means, standard deviations, and *t* results.

Table 5

*Comparison of K-5 Elementary (*n *= 109) and Grades 6-12 Secondary (n =131) Teacher Perceptions of Technology Support Available*

Variable	*M*	*SD*	*t*	*df*	*p*	*d*
Support			0.19	238	.847	0.02
Elem	30.76	4.54				
Sec	30.88	5.18				

Note. Support = Teacher Perceptions of Technology Support Available; Elem = Elementary; Sec = Secondary.

The independent samples *t*-test results showed no statistically significant difference between the groups, $t(238) = 0.19$, $p = .847$. See Figure 5 for means of teacher perceptions of support for technology of elementary and secondary teachers.

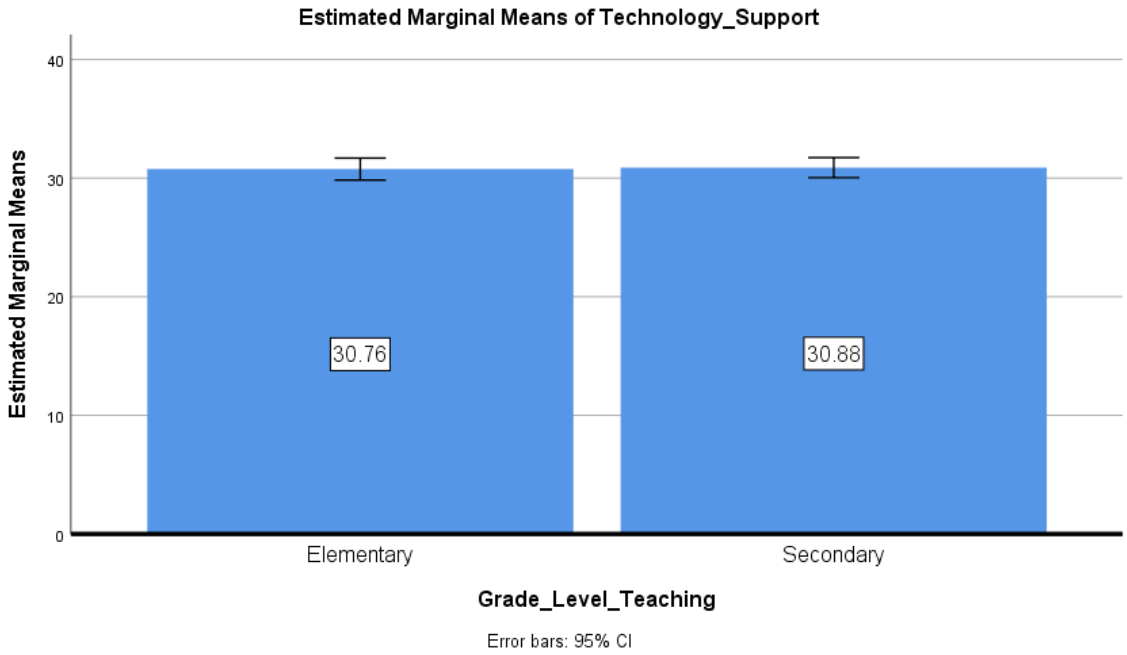

Figure 5. Means of Teacher Perceptions of Technology Support Available of Elementary and Secondary Teachers

The mean of the teacher perceptions of technology support scores of elementary teachers ($M = 30.76$, $SD = 4.54$) was not significantly different from that of secondary teachers ($M = 30.88$, $SD = 5.18$). The effect size, $d = 0.02$, was small (Leech et al., 2015). Therefore, the null hypothesis was retained.

Hypothesis 5

Hypothesis 5 stated that no significant difference will exist between 0-5 years of teaching experience versus 6+ years of experience on teacher perceptions of comfort with

technology measured by a modified survey combining items from the USEIT survey and the PETI survey for teachers in six school districts in Central Arkansas. The assumptions of independent observations, normal distributions of the dependent variable for each group, and homogeneity of variances were checked. The study's design was such that the assumption of independent observations was met; no subject contributed scores in more than one group. The Shapiro-Wilk test for normality indicated that the assumption of normality was violated; Novice, $W(73) = 0.87$, $p < .001$; Experienced, $W(167) = 0.88$, $p < .001$. Both groups were slightly negatively skewed. Although this abnormality existed within the data, the *t*-test was robust to violations of normality, especially when both groups were skewed in the same direction (Leech et al., 2020). No extreme outliers were present. Levene's test, $F(238) = 0.52$, $p = .470$, indicated that homogeneity of variances was not violated, and the assumption was met. See Table 6 for the means, standard deviations, and *t* results.

Table 6

*Comparison of Novice (*n = *73) and Experienced (*n = *167) Teacher Perceptions of Teacher Comfort with Technology*

Variable	*M*	*SD*	*T*	*df*	*p*	*d*
Comfort			1.88	238	.062	0.27
Novice	20.81	3.07				
Exper	19.90	3.60				

Note. Comfort = Teacher Perceptions of Comfort with Technology; Exper = Experienced.

Results of the independent samples *t*-test showed no statistically significant difference between the groups, $t(238) = 1.88$, $p = .062$. See Figure 6 for means of teacher perceptions of comfort with technology of novice and experienced teachers.

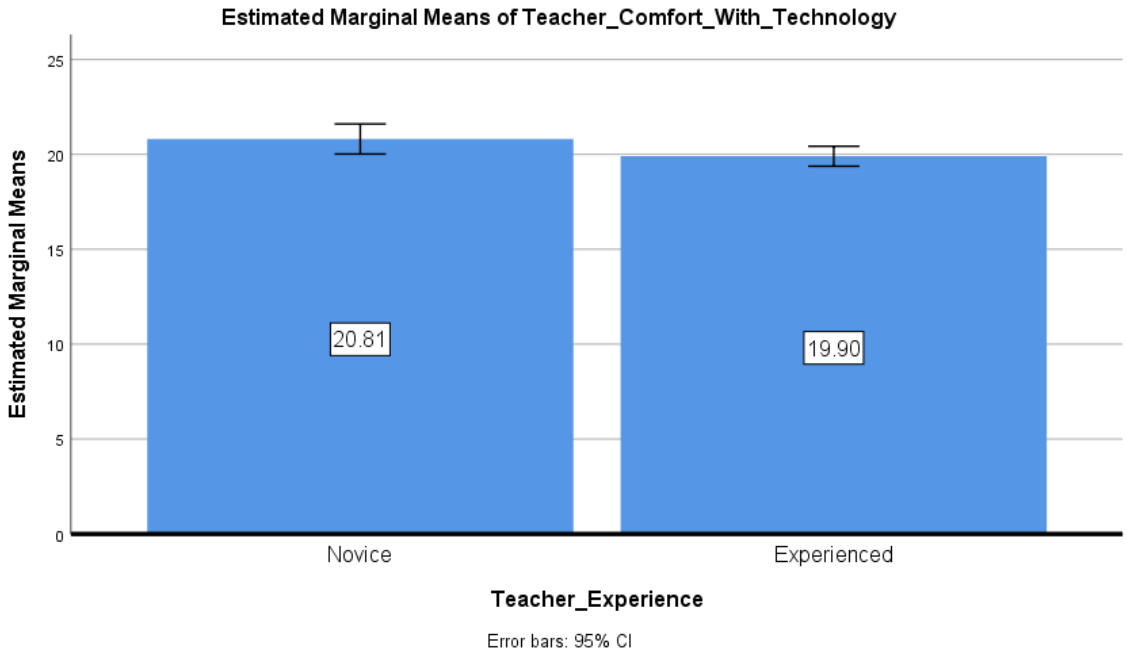

Figure 6. Means of novice and experienced teacher perceptions of comfort with technology.

The mean of the teacher perceptions of comfort with technology scores of novice teachers ($M = 20.81$, $SD = 3.07$) was not significantly different from that of experienced teachers ($M = 19.90$, $SD = 3.60$). The effect size, $d = 0.27$, was large (Leech et al., 2015). Therefore, the null hypothesis was retained.

Hypothesis 6

Hypothesis 6 stated that no significant difference will exist between 0-5 years of teaching experience versus 6+ years of experience on teacher perceptions of technology-

based professional development measured by a modified survey combining items from the USEIT teacher survey and the PETI survey for teachers in six school districts in Central Arkansas. The assumptions of independent observations, normal distributions of the dependent variable for each group, and homogeneity of variances were checked. The study's design was such that the assumption of independent observations was met; no subject contributed scores in more than one group. The Shapiro-Wilk test for normality indicated that the assumption of normality was violated; Novice, $W(73) = 0.96$, $p = .019$; Experienced, $W(167) = 0.98$, $p = .007$. No extreme outliers were present. Levene's test, $F(238) = 5.55$, $p = .019$, indicated that homogeneity of variances was violated, and the assumption was not met. Therefore, *t*-test results from the equal variances not assumed analysis was used. See Table 7 for the means, standard deviations, and *t* results.

Table 7

*Comparison of Novice (*n *= 73) and Experienced (*n *= 167) Teacher Perceptions of Technology-Based Professional Development*

Variable	*M*	*SD*	*t*	*df*	*p*	*d*
Prof Dev			1.17	173.03	.243	0.16
Novice	19.60	3.81				
Exper	18.92	4.86				

Note. Prof Dev = Teacher Perceptions of Technology-Based Professional Development; Exper = Experienced.

Results of the independent samples *t*-test showed no statistically significant difference between the groups, $t(173.03) = 1.17$, $p = .243$. See Figure 7 for means of teacher perceptions of technology-based professional development of novice and experienced teachers.

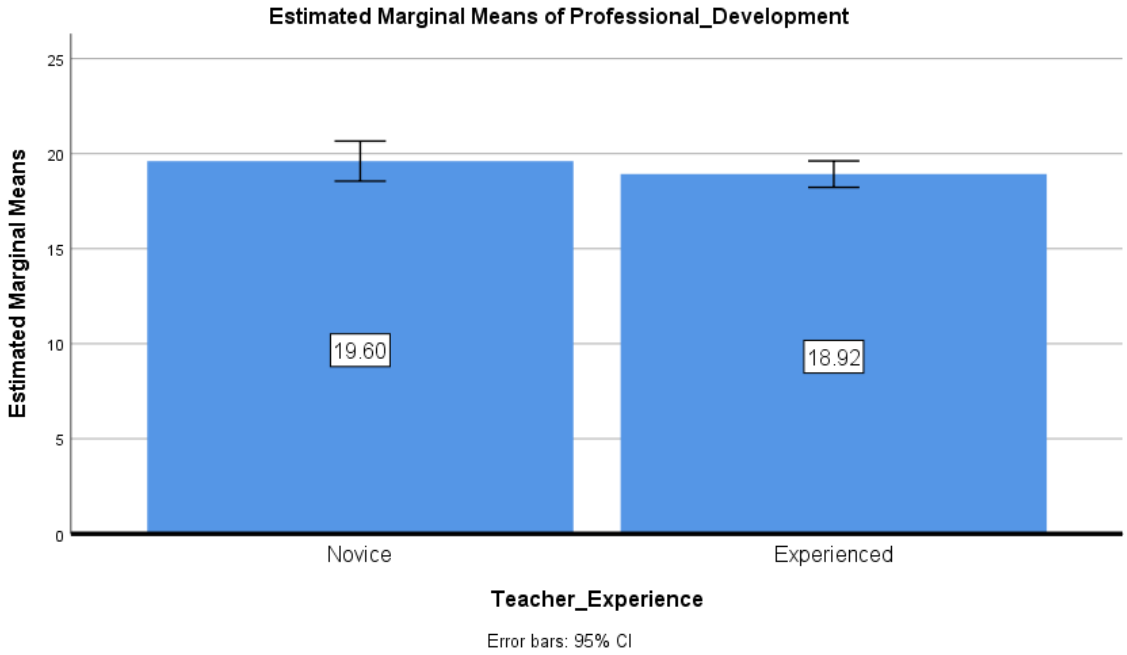

Figure 7. Means of novice and experienced teacher perceptions of technology-based professional development.

The mean of the teacher perceptions of technology-based professional development scores of novice teachers ($M = 19.69$, $SD = 3.81$) was not significantly different from that of experienced teachers ($M = 18.92$, $SD = 4.86$). The effect size, $d = 0.16$, was large (Leech et al., 2015). Therefore, the null hypothesis was retained.

Hypothesis 7

Hypothesis 7 stated that no significant difference will exist between 0-5 years of teaching experience versus 6+ years of experience on teacher perceptions of obstacles to technology usage measured by a modified survey combining items from the USEIT teacher survey and the PETI survey for teachers in six school districts in Central Arkansas. The assumptions of independent observations, normal distributions of the dependent variable for each group, and homogeneity of variances were checked. The study's design was such that the assumption of independent observations was met; no subject contributed scores in more than one group. The Shapiro-Wilk test for normality indicated that the assumption of normality was not violated; Novice, $W(73) = 0.99$, $p = .534$; Experienced, $W(167) = 0.99$, $p = .141$. No extreme outliers were present. Levene's test, $F(238) = 0.00$, $p = .988$, indicated that homogeneity of variances was not violated, and the assumption was met. See Table 8 for the means, standard deviations, and *t* results.

Table 8

*Comparison of Novice (*n = *73) and Experienced (*n = *167) Teacher Perceptions of Obstacles to Technology Usage*

Variable	*M*	*SD*	*t*	*df*	*p*	*d*
Obstacles			0.79	238	.432	0.11
Novice	22.12	5.04				
Exper	22.68	5.09				

Note. Obstacles = Teacher Perceptions of Obstacles to Technology Usage; Exper = Experienced.

Results of the independent samples *t*-test showed no statistically significant difference between the groups, $t(238) = 0.79$, $p = .432$. See Figure 8 for means of teacher perceptions of obstacles to technology usage of novice and experienced teachers.

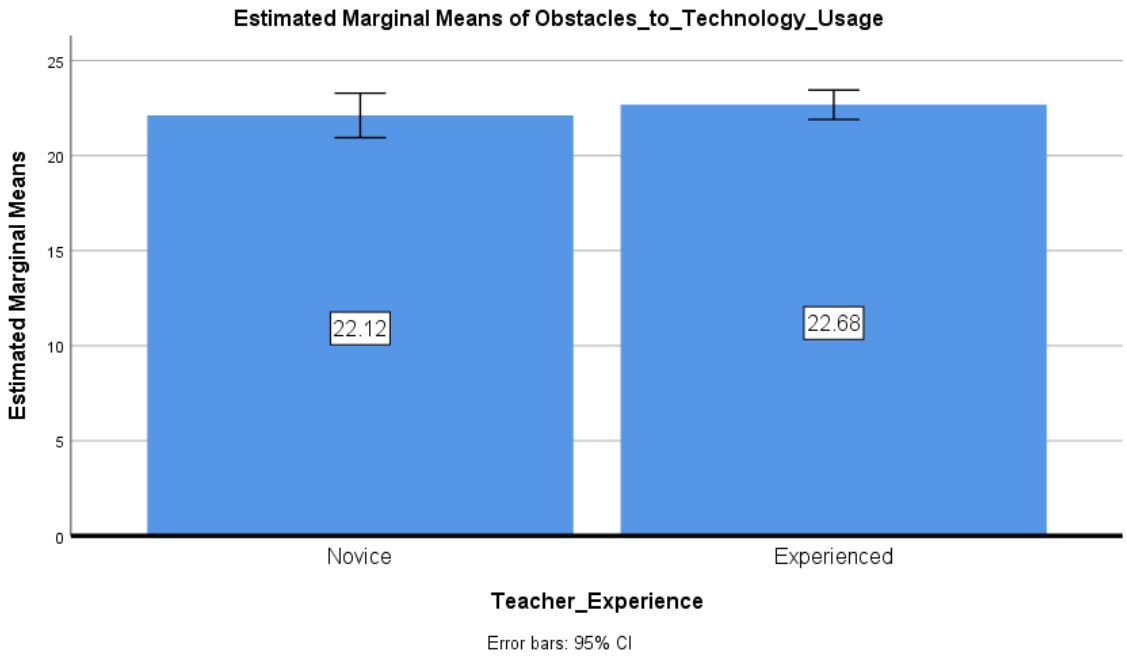

Figure 8. Means of novice and experienced teacher perceptions of obstacles to technology usage.

The mean of the teacher perceptions of obstacles to technology usage scores of novice teachers (M = 22.12, SD = 5.04) was not significantly different from that of experienced teachers (M = 22.68, SD = 5.09). The effect size, d = 0.11, was medium (Leech et al., 2015). Therefore, the null hypothesis was retained.

Hypothesis 8

Hypothesis 8 stated that no significant difference will exist between 0-5 years of teaching experience versus 6+ years of experience on teacher perceptions of technology support available measured by a modified survey combining items from the USEIT teacher survey and the PETI survey for teachers in six school districts in Central Arkansas. The assumptions of independent observations, normal distributions of the

dependent variable for each group, and homogeneity of variances were checked. The study's design was such that the assumption of independent observations was met; no subject contributed scores in more than one group. The Shapiro-Wilk test for normality indicated that the assumption of normality was violated; Novice, $W(73) = 0.92$, $p < .001$; Experienced, $W(167) = 0.94$, $p < .001$. Both groups were slightly negatively skewed. Although this abnormality existed within the data, the *t*-test was robust to violations of normality, especially when both groups were skewed in the same direction (Leech et al., 2020). No extreme outliers were present. Levene's test, $F(238) = 1.58$, $p = .210$, indicated that homogeneity of variances was not violated, and the assumption was met. See Table 9 for the means, standard deviations, and *t* results.

Table 9

*Comparison of Novice (*n *= 73) and Experienced (*n *= 167) Teacher Perceptions of Technology Support Available*

Variable	*M*	*SD*	*t*	*df*	*p*	*d*
Support			0.58	238	.560	0.08
Novice	31.11	4.36				
Exper	30.71	5.11				

Note. Support = Teacher Perceptions of Technology Support Available; Exper = Experienced.

Results of the independent samples *t*-test showed no statistically significant difference between the groups, $t(238) = 0.58$, $p = .560$. See Figure 9 for means of teacher perceptions of technology support available for novice and experienced teachers.

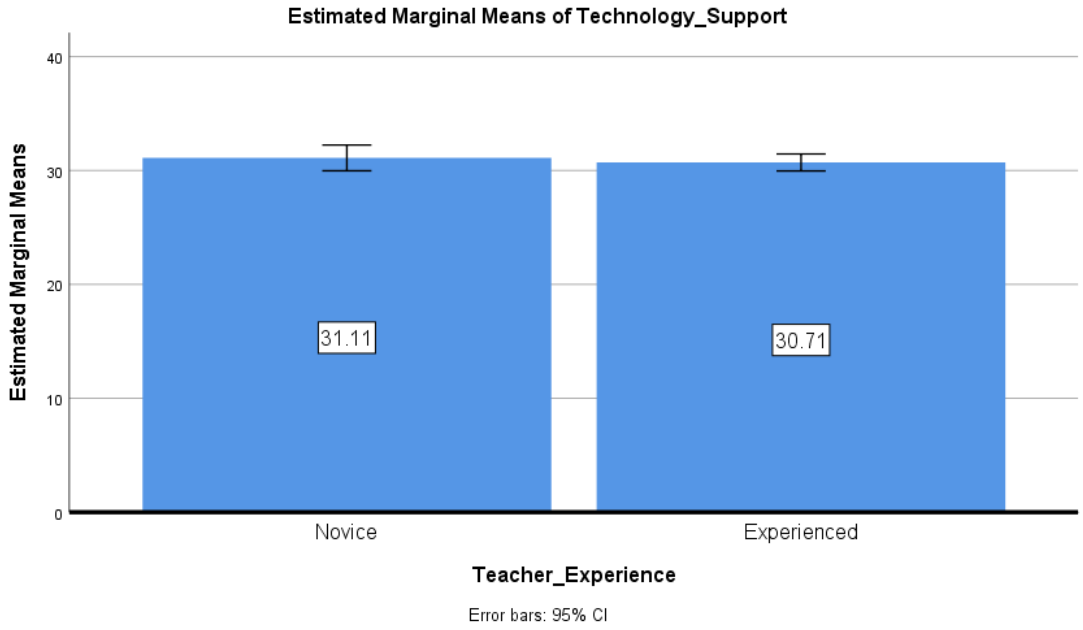

Figure 9. Means of novice and experienced teacher perceptions of technology support available.

The mean of the teacher perceptions of technology support available scores of novice teachers ($M = 31.11$, $SD = 4.36$) was not significantly different from that of experienced teachers ($M = 30.71$, $SD = 5.11$). The effect size, $d = 0.08$, was medium (Leech et al., 2015). Therefore, the null hypothesis was retained.

Summary

Hypotheses 1-4 examined the effects of teaching grade level on teacher perceptions of comfort with technology, teacher perceptions of technology-based

professional development, teacher perceptions of obstacles to technology usage, and teacher perceptions of technology support available. Hypotheses 5-8 investigated the effects of years of teaching experience on the same four constructs. Table 10 presents a summary of the *t*-test results.

Table 10

Summary of Statistical Significance of Grade-Level Teaching Assignment and Years of Teaching Experience on Teacher Perceptions by Hypothesis

	Variables	
H_0	Grade Level	Years of Experience
H_1	.899	
H_2	.499	
H_3	.066	
H_4	.847	
H_5		.062
H_6		.243
H_7		.432
H8		.560

Of the eight independent samples *t*-tests run, years of teaching experience and grade-level teaching assignment did not significantly affect the four primary constructs measuring teacher perceptions of technology. Even though literature in the field acknowledged that differences exist in teachers based on years of experience and grade-level teaching assignment, the data indicated no significant differences in teacher perceptions of

technology based on these factors. The discussion, implications, and conclusions are drawn in Chapter 5.

CHAPTER V

DISCUSSION

Technology in the classroom has evolved exponentially over the last few decades, and teacher perceptions of classroom technology have varied along with the changes. In many places, chalkboards have been replaced with Smartboards and interactive display panels, and pens and paper have been replaced with laptops. Technology has played an integral role in education, especially during the COVID-19 pandemic. Teachers used technology to teach remotely during pandemic-related school closures and forced quarantines, allowing instruction to continue (Perozek, 2020). This study sought to use the TAM, a theoretical framework model by Fred Davis (1987), which advances the idea that a technological product's perceived usefulness and ease of use will influence a user's perception of the product and eventual intention to use the product. Through the lens of the TAM framework, technology's increased usefulness during the pandemic may have positively influenced teacher perceptions of technology.

Even during prepandemic times, technology had many positive benefits that may influence teacher perceptions, along with some inherent difficulties of use which may also influence perceptions. Exploring elements that affected teachers' perceptions of technology guided this research. Although computer-based technology has been in classrooms since the late 1970s (Thornburg, 2014), the need for an investigation into variables that influence teachers' perceptions and subsequent usage of technology has

been heightened because of the COVID-19 pandemic and subsequent school shutdown (Perozek, 2020). Although this research focused on teacher perceptions, the TAM indicated that users' perceptions of technology influence technology usage. Years of experience and grade-level teaching assignment may have affected how teachers adapted to new instructional methods and their perceptions of technology. However, Teo (2014) revealed no differences between elementary and secondary teacher perceptions of technology, although he asserted that teachers with fewer than 7 years of experience perceived technology more favorably than teachers with 7 or more years of experience. Ballew (2017) did not obtain similar results when studying the same independent variables on teacher perceptions of technology. While studying teacher perceptions of Google Classroom, Ballew reported differences in teachers' perceptions of Google Classroom based on years of experience, grade-level teaching assignment, and subject. Ballew asserted that teachers with fewer years of experience and high school teachers were more likely to use technology than more experienced teachers or elementary teachers. This study sought to determine which of these seemingly contradictory views were confirmed for the teachers surveyed in Central Arkansas in the spring of 2021.

Years of experience and grade-level teaching assignment are not the only suspected influences on teacher perceptions. Peng and Wong (2018) found that educational beliefs, rather than either of these independent variables, played a more prominent role in teacher perceptions and subsequent use, with teachers who held constructivist beliefs about learning to view technology more favorably. Peng and Wong also asserted that teachers who used technology more often perceived technology positively and used the technology in the classroom. The results of this study supported

the research of Teo (2014) and Peng and Wong (2018), that other factors, possibly teacher personal beliefs or personal technology usage of teachers, rather than years of experience and grade-level teaching assignment, influences teacher perceptions of technology. This study indicated that neither years of experience nor grade-level teaching assignment affected teacher perceptions of technology on teacher comfort with technology, teacher perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, or teacher perceptions of technology support available. Independent sample *t*-tests were conducted, and this chapter translates the findings into conclusions and implications and offers recommendations for practice and policy for school leaders and future research considerations.

Findings and Implications

The focus of this study was to determine if years of experience (Novice = 0-5 years of experience versus Experienced= 6+ years of experience) or grade-level teaching assignment (Elementary = K-5 versus Secondary = 6-12) significantly affected teacher perceptions of comfort with technology, teacher perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, or teacher perceptions of technology support available in six central Arkansas school districts. Eight independent sample *t*-tests were conducted to address the eight hypotheses. Four were conducted to address the independent variable of years of experience. Similarly, four were conducted to address the independent variable of grade-level teaching assignment. The dependent variables for the eight independent sample *t*-tests were teacher perceptions of technology on teacher comfort with technology, teacher

perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, and teacher perceptions of technology support available.

Teacher Perceptions of Teacher Comfort with Technology

This study did not reveal that years of experience or grade-level teaching assignment influenced teacher perceptions of teacher comfort with technology. Hypotheses 1 and 5 focused on teacher comfort with technology and indicated very little difference in the mean scores of novice versus experienced teachers or elementary versus secondary teachers in questions concerning perceptions of teacher comfort with technology. The null was retained for both hypotheses, which means no statistical difference was found between the two groups divided by years of experience and grade level teaching assignments.

The TAM framework indicated that if the technology was relatively easy to use and useful to the teacher, teachers had positive perceptions of the technology and subsequently use the technology. Following the framework, teacher comfort with technology may be based on prior usage of technology. Kilicer et al. (2018) asserted that teachers performing technological tasks that required higher levels of thinking would increase teacher comfort with technology, so exposing teachers to increasingly complicated technological tasks would increase their comfort and subsequent perceptions of technology and usage. Parks et al. (2017), examining teacher perceptions of technology, also supported the TAM framework. Parks found that teacher comfort and success with technology will vary with prior knowledge and level of implementation. Like the TAM emphasized, ease of use influenced perceptions. Prior experiences influence ease of use.

The TAM framework has addressed the influence of experience with technology on teacher perceptions of technology. However, experience with technology's influence on teacher perceptions of technology is not an idea exclusive to the framework (Kilicer et al., 2018; Parks et al., 2017). Peng and Wong (2018) reiterated that the more experiences teachers have with technology, the more comfortable they become. Peng and Wong further recommended that teachers receive training in classroom activities to increase their comfort with technology. With the results of this study, Peng and Wong's claim can be applied to teachers across grade-level teaching assignment and years of experience equally. Increasing teacher experiences with technology will increase teacher comfort with technology and their subsequent usage of technology.

Teacher Perceptions of Technology-based Professional Development

This study did not reveal that years of experience or grade-level teaching assignment influenced teacher perceptions of technology-based professional development. Hypotheses 2 and 6, related to professional development, indicated little difference in mean scores of novice versus experienced teachers or elementary versus secondary teachers in questions concerning perceptions of professional development. The null hypothesis was retained for both hypotheses, which means no statistical difference was found between the two groups in either hypothesis.

The TAM framework proposes that the appeal of a technology product is based on ease of use and usefulness, so technology-based professional development must demonstrate that the technology product is easy to use and demonstrate how the product will make the teacher's job more manageable. This process will lead to positive teacher perceptions of the technology. A literature review did reveal that best practices for

technology-based professional development include strong administrative involvement in professional development. Demski (2012) determined that the principal must support and train teachers in technology. As the instructional leader of the building, the principal should assist and instruct teachers in effective teaching methods, including technology. Topper and Lancaster (2013) noted that the need for administrative support must begin with the superintendent supporting a vision for the importance of technology. They noted that the superintendent should stress the positive influence and lifelong skills obtained by using technology. Topper and Lancaster also found that preparation for technology implementation was key to successful implementation. Effective technology leadership will include modeling skills as well as communication.

School leaders may also want to support technology by offering adequate time for technology training and offering professional development. Wei et al. (2009) and Tucker (2019) determined that teachers learn best in short lessons throughout the school year as part of a professional learning community rather than in long sessions in the summer. Teaching technology skills must be scheduled appropriately. Tang and Chaw (2016) concluded that training teachers and students in technology skills must happen before the need becomes immediate, which happened during the COVID-19 pandemic. Fagan et al. (2017) suggested that while professional development provided an opportunity for teachers to cultivate skills consistent with best practices in the field, teacher acceptance of what is being presented that ultimately determines the effectiveness of the professional development. Achieving teacher acceptance is not a simple process. Fagan et al. (2017) and Brzycki and Dudt (2005) found that the inherent appeal of the technological product would ultimately determine teacher perceptions of the product, although the

attractiveness of the training package would also influence perceptions. This assertion correlates with the TAM framework because teacher training will make the product easier to use, thus increasing positive perceptions and eventual usage of the technology.

Teacher Perceptions of Obstacles to Technology Usage

This study did not reveal that years of experience or grade-level teaching assignment influenced teacher perceptions of obstacles to technology usage. Hypotheses 3 and 7, related to obstacles to technology usage, indicated no statistically significant difference in mean scores of novice versus experienced teachers or elementary versus secondary teachers in questions concerning perceptions of obstacles to technology usage. The null was retained for both hypotheses, which means no statistical difference was found between the two groups divided by years of experience and grade level teaching assignments.

The TAM framework emphasized that obstacles to usage might be related to the difficulty of use and lack of usefulness. The literature review did not fully support these two obstacles. Kearney et al. (2018) cautioned that lack of communication is the largest barrier to effective technology implementation and positive perceptions. Kearney et al. recommended that teachers provide input at all stages of the technology implementation process. Effective communication must be joined with other methods to overcome obstacles. Demski (2012) contended that multiple methods should be used to overcome obstacles. Materials for different technological ability levels, individual classroom-level instructional technology support, and mentoring programs between experienced and inexperienced teachers are suggested. Demski (2012) also determined that positive working relationships between instructional technology staff, administrators, and teachers

are required to overcome obstacles to technology usage. Positive communication and working relationships between staff members can help overcome potential obstacles. Okmawati (2020) discussed an obstacle that became increasingly problematic during the COVID-19 pandemic. Lack of Internet access at home was an obstacle during the pandemic and remains a relevant issue today (Perozek, 2020). Schaffhauser (2017) found the lack of infrastructure at the district and state level also existed prepandemic. Ensuring time, devices, infrastructure, and professional development are available is necessary for successful instructional technology implementation (Schaffhauser, 2017). The TAM would lead readers to consider lack of access as a significant obstacle because lack of access is related to ease of use; therefore, school and community leaders should address ready access to the Internet for many reasons, including improving perceptions of technology.

Teacher Perceptions of Technology Support Available

This study did not reveal that years of experience or grade-level teaching assignment influenced teacher perceptions of technology support available. The results of hypotheses 4 and 8, related to available technology support, indicated very little difference in mean scores of novice versus experienced teachers or elementary versus secondary teachers in questions concerning perceptions of technology support available. The null was retained for both hypotheses, which means no statistical difference was found between the two groups in either hypothesis.

Providing technology support for educators does not have to mean increasing the size of the instructional technology department, which can be costly for districts. Lubarsky and Thomas (2020) determined that educators must overcome functional

fixedness to find creative solutions for providing technology support during COVID-19 increased technology use. Hiring additional technology support staff is one method of providing technology support but not the only method. Castelo (2020) suggested that instructional technology departments automate their ticketing system to handle frequent and low-level technology support requests, such as password resets. Along with automating simple tasks, mentoring programs in technology may also be useful. Demski (2012) disclosed that administrators also support teachers with technology issues and set up mentoring programs between teachers who are comfortable with a technology product and those who are not. Providing technology support can be accomplished through various avenues, but research suggests the support is required. Kearney et al. (2018) found that if a district cannot provide the training and follow-up technology support, the purchase cost of the technology is wasted. Due to the pandemic, remote learning required many districts to increase technology and devices, but low socioeconomic districts still faced lower student achievement results without technology support (Warschauer et al., 2014). Technology support would influence ease of use, which the TAM would suggest significantly influences teacher perceptions of technology. Technology initiatives' success depends on available technology support and positive teacher perceptions of the technology (Tucker 2019). The TAM framework would support that the availability of technology support would play a prominent role in teacher perceptions of technology as teachers' perceived ease of use of technology would influence their perceptions of technology.

Recommendations

Potential for Practice/Policy

This study attempted to determine if grade-level teaching assignment and years of teaching experience influenced teacher perceptions of comfort with technology, teacher perceptions of technology-based professional development, teacher perceptions of obstacles to technology usage, and teacher perceptions of technology support available in six Central Arkansas school districts. Although the study did not find that grade-level teaching assignment or years of experience influenced teacher perceptions of these variables, insights were gained during examining literature that could provide school leaders with valuable recommendations post COVID-19.

The first recommendation for school leaders is related to increasing teacher comfort with technology. Leaders should encourage teachers to use technology in productivity tasks, not just in presenting information to students. Increased usage of technology will increase teacher comfort with technology and lead to more effective use. For example, to familiarize teachers with Google Classroom, the school administrator may use a Google Classroom for the building with teachers as students in the class (Morquin, 2016). Familiarity with the product will increase teacher comfort with the product as the TAM would support. Administrators may also choose to hold meetings by Zoom so that educators can socially distance themselves in their classrooms or work remotely. Demonstrating this skill with staff will allow educators to become more familiar with products they may wish to incorporate. Increasingly complex assignments can be shared with teachers. Principals can perform school housekeeping tasks such as sharing lesson planning templates and presentations from faculty meetings via learning

management platforms. Teachers can also use shared documents and spreadsheets to organize and share information with colleagues. Increased comfort with technology will lead to positive perceptions of technology.

Based on this research and the study results, the second recommendation is to make technology a priority tied to the school's vision. Leaders sharing a vision of making technology important for both teachers and students is critical to the success of technology initiatives (Topper & Lancaster, 2013). The priority placed on technology must be shared early in any initiative to increase educator acceptance. Open communication with stakeholders and allowing teachers to help plan for technology implementation are critical. Principals can be role models in using technology (Demski, 2012). School leaders may encourage innovativeness and technology-based risk-taking by working with products themselves (Kilicer et al., 2018). Including stakeholders in the technology plan will also lead to increased positive teacher perceptions of technology.

The third recommendation focuses on how to deliver effective technology-based professional development. Technology training should be shared throughout the school year in short sessions by fellow teachers and school administrators rather than long sessions in the summer by outside technology experts (Wei et al., 2009). Delivering professional development in this manner allows educators to learn from their peers and allows school leaders to model effective use of technology. Technology training should be short, appealing, engaging, and relevant with the ability to practice new skills immediately (Brzycki & Dudt, 2005). The ability to practice the skill with a classroom of students soon after presenting professional development is often lacking in traditional summer professional development. Following these recommendations for technology-

based professional development could increase positive teacher perceptions of technology.

The fourth recommendation would be for school leaders to find multiple, creative methods of supporting teachers with technology. Automating technology requests with an online ticketing system that can handle simple requests like password resets is one way to free up technology staff to support teachers in higher-level technology training. Teachers must have positive working relationships with several sources of support for using technology. Library media specialists, instructional facilitators, fellow teachers, administrators, and student technology teams can support teachers with technology. Increasing instructional technology staff does not have to be the only solution to increased technology usage. Solving how to use technology to address pandemic-related needs effectively is not a quick solution for a temporary problem. Pandemic-era learning may provide a glimpse into education in the future, so placing importance on supporting educators with technology can only be beneficial in the future.

The final recommendation would be for school district leaders to look at the infrastructure of technology. Effectively addressing infrastructure issues is a task each community's leaders will need to consider, as each community will face its challenges. Arkansas districts experienced a lack of infrastructure during remote learning for students and remote working for teachers. In many areas of rural Arkansas, even a district-provided hotspot does not provide connectivity due to a lack of cellular coverage in the area (Beirne, 2021). Governor Hutchinson provided $10 million to Arkansas districts to increase hotspots, but without cellular coverage, the hotspots were not as effective as they could have been (Arkansas.gov, 2020). This study does not attempt to address this issue,

but as the issue certainly plays a role in the difficulties of teaching with technology during the COVID-19 era, it is an important one that may impact teacher perceptions of technology.

Future Research Considerations

Several factors may be considered when examining teacher perceptions of technology. This research did not demonstrate that teacher years of experience or grade-level teaching assignment influenced teacher perceptions of technology. Future research considerations should include the following to strengthen the body of research on this topic.

1. Future researchers could collect additional data about the personal technology usage habits of teachers. Teachers could respond to questions about technology usage in their personal lives and correlate the findings to professional usage. Kilicer et al. (2018) and Peng and Wong (2018) established that the more teachers use technology in their personal lives, the more likely they perceive technology positively.
2. Taking two somewhat outdated surveys and modifying them into one survey may be considered a limitation future researchers need to consider. The survey used in this research updated some of the specific technology products or methods used in the original PETI and USEIT surveys. However, future researchers may consider designing a survey with updated technological methods or products frequently used during the pandemic, with questions like the following: *Before the 2019-2020 school year, how favorable was your*

perception of video conferencing? and *After teaching in 2020-2021, how favorable is your perception of video conferencing?*

3. Future researchers may consider expanding the geographical homogeneity of the teachers surveyed. The teachers responding to this survey were located in Central Arkansas, and future surveys could be distributed to a broader range of teachers.
4. Other stakeholder perceptions of technology and the pandemic's effect on those perceptions may warrant future research. Other stakeholders' perceptions may include students, parents, and administrators.
5. Finally, technology's effect on teaching methodology has not been thoroughly explored during or postpandemic. Azhar and Iqbal (2018) suggested that technology, while useful for document management, does not improve teaching methodology. This topic and related remote teaching has not been examined since the advent of COVID-19 and may be a topic for future researchers.

Conclusion

In conclusion, what guided teacher perceptions of technology in this study was not years of experience or grade-level teaching assignment. Looking to the TAM for guidance, how easy the technology was to use, and how useful the product was to the teacher usually guided perceptions. Using best practices for professional development for educators is critical, and the literature review suggested school leaders offer technology-based professional development in professional learning communities (Wei et al., 2009). Sauro (2019) summarized that teachers would use technology if technology makes their

work easier, even if using the technology is somewhat difficult to support the TAM framework. Teacher perceptions of technology are complex, and perceptions are influenced by the schools' actions and personal beliefs (Scherer & Teo, 2019). Their perceptions of technology may have also been influenced by the requirement to teach students remotely during the pandemic. This study indicated that presenting teachers with technology that makes their difficult jobs easier to perform and easy to use will affect actual teacher usage and perceptions of technology in a pre or postpandemic educational landscape. Positive teacher perceptions of technology can empower teachers to instruct students in the 21st century effectively.

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