THE INFLUENCE OF EARLY-CHILDHOOD TEACHERS' PERCEPTIONS, ATTITUDES, AND TECHNOLOGY PROFICIENCY ON EDUCATIONAL TECHNOLOGY USE IN EARLY-CHILDHOOD CLASSROOMS

by

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ABSTRACT

THE INFLUENCE OF EARLY-CHILDHOOD TEACHERS' PERCEPTIONS, ATTITUDES, AND TECHNOLOGY PROFICIENCY ON EDUCATIONAL TECHNOLOGY USE IN EARLY-CHILDHOOD CLASSROOMS

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Early childhood is a critical time to form the foundations required for success in education and life. Additionally, the 21st century has catapulted the world into an age of technology. It is imperative to find balance between the use of traditional teaching methods and ways to implement developmentally appropriate technology in early-childhood classrooms. The purpose of this study was to investigate the impact of early-childhood teachers' perceptions, attitudes, and technology proficiency on educational technology use in early-childhood classrooms. To help answer the research questions, a random sample of early-childhood educators was selected to answer two established scale surveys on attitude towards technology and technology proficiency. Additionally, interviews were conducted to ascertain how teachers perceive the use of educational technology as a developmentally appropriate practice. A mixed-methods design was

employed, and examination of quantitative survey results and qualitative interviews provided insight into teachers' perceptions, attitudes, and proficiency of technology use in early-childhood classrooms as compared to their age and years of service.

Findings indicated early-childhood teachers with more years of service are more likely to feel confident in their proficiency with technology skills, resulting in higher implementation in their early-childhood classrooms. Additionally, early-childhood teachers' attitudes towards educational technology do not change based on years of service. Furthermore, as an early-childhood teacher's technology proficiency increases, his or her attitude towards technology also increases. Finally, although answers varied, all participants shared a conviction for doing what is developmentally appropriate for early-childhood students and felt quality instruction should be the most important goal in all early-childhood classrooms. This study revealed the need for teachers to feel competent in their abilities to use educational technology in early-childhood classrooms, despite their years of service.

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CHAPTER I:

INTRODUCTION

Prior to the structure of 21st century learning, teachers and textbooks were the primary communicators of educational knowledge, but today children as young as three years of age use technology as a learning tool more than their parents did at their age, and anyone with internet access can obtain information from anywhere in the world (Blake, Winsor, Burkett, & Allen, 2011; Ramsey, 2018). By the time children reach the age of four, over 96% can use mobile technology (Hatzigianni & Kalaitzidis, 2018). This percentage has risen despite advice from the American Academy of Pediatrics (AAP) warning against technology use at a young age. This advice stemmed from fear of developmental detriments resulting from overexposure to touch screen technology (Strasburger, 2015). Until 2016, the AAP recommended children under the age of two not use touchscreen technology at all, while children over the age of two should be limited to no more than two hours per day (Hatzigianni & Kalaitzidis, 2018).

While technology applications may provide some cognitive benefits, there is mounting evidence in cognitive neuroscience literature indicating digital technology restructures the way students read and think, and not necessarily for the better (Cavanaugh, Giapponi, & Golden, 2016). Despite the warnings, educational institutions are setting standards for technology use in schools, including early-childhood classrooms. Additionally, the availability of technology influences all aspects of early-childhood students' and teachers' lives and integration of education technology in an early-childhood classrooms is essential in equipping students with the necessary skills needed for success in the 21st century. (Blake et al., 2011; Smith, Burrow, Fite, & Guerra, 2016). As a result of the evidence in cognitive neuroscience literature and early-childhood students' more frequent exposure to educational technology, further research is needed to

investigate if and how educational technology is being effectively implemented in early-childhood classrooms. This study will provide a better understanding on how early-childhood teachers attitudes, technology proficiency, and perceptions of best practices influence the implementation of educational technology in early-childhood education.

Research Problem

Over the past 10 years, children's playtime activities have dramatically changed due to readily available electronic games on mobile devices and touch screen tablets and the technology revolution has proven both fast and furious (Moawad, 2017; Tondeur, De Bruyne, Van Den Driessche, McKinney, & Zandvliet, 2015). Advances in technology mean electronic gaming systems are inexpensive, more accessible, and can be utilized at any time or place (Moawad, 2017). As a result, children spend more time playing with technology in lieu of more hands-on activities. Additionally, a study conducted by Hearst, Wang, Grannon, Davey, and Nanney (2017), indicated 41.0% of students used computers for three or more hours per day; showing young children are engaged in technological activities for at least 25% of the day.

Research has highlighted both positive and negative effects of electronic games on growth and development of early-childhood children (Cavanaugh et al., 2016; Parette et al., 2009; Strasburger, 2015). While some researchers have noted positive effects of electronic game play, such as increased mathematics concepts, improved hand-eye coordination, increased self-esteem, and reduced reaction time (Griffiths, 2002; Yee, 2006), other studies have also shown detriments from electronic game play, such as increased aggressiveness and medical/psychosocial effects, language deficits, and obesity (Griffiths, 2002). This is consistent with findings of Strasburger (2015), who substantiated recommendations from the AAP, using a study, which found negative effects of technology on babies, such as obesity, aggression, and decreased language

development. In addition, Strasburger (2015) stated, “Until there is good evidence that exposing babies to touch screens yields positive benefits that outweigh negative ones, there seems little point in recommending iPads and smartphones to parents of infants” (p. 968).

These inconsistencies in prior research make it difficult for early-childhood teachers to ignore Developmentally Appropriate Practice (DAP), or what practitioners identify as the framework for age appropriate teaching in early-childhood environments (Blake et al., 2011), and to successfully implement educational technology in their classrooms. Furthermore, a study conducted by Parette, Quesenberry, and Blum (2009), found a discrepancy between the visions preservice teachers have regarding the implementation of educational technology and the reality of their practices once they enter the classroom. Early-childhood teachers often forgo educational technology for fear it will hinder the personal relationships crucial for DAP (Parette et al., 2009).

By the time most students enter kindergarten, they are well acquainted with touch-based technology. Some students can navigate a touch-screen tablet, such as an iPad, but cannot trace or form letters of the alphabet. Instead, they use pictures on applications to convey their writing (Beschorner & Hutchison, 2013). Additionally, because of the fast growth in technology exposure, generations Y (1980 - 1994) and Z (1995 - 2009) will be digitally literate before they even open their first book (Richtel & Bosman, 2011). Considering the increased exposure to touchscreen technology, early-childhood teachers are rethinking the role of educational technology in their classrooms (Beschorner & Hutchison, 2013). Furthermore, prior cognitive research has raised many questions regarding brain development and morphology, reinforcing concerns about the analytical skill development of 21st century learners (Cavanaugh et al., 2016). Is it still

not clear how educational technology activities are influencing the cognitive development of early-childhood students and as a result, further research is warranted.

Early-childhood experiences help students learn crucial foundational skills needed for effective transitions into educational environments, active participation in academia, and successful achievement in key content areas, which should be implemented through the lens of a 21st century society (Parette et al., 2009). Additionally, developmentally appropriate practices in the implementation of educational technology are still being debated as an underlying pedogeological framework. (Blake et al., 2011). As a result, many early-childhood teachers struggle with how to effectively implement educational technology in their classrooms. Overall, researchers determined an indirect correlation between electronic games and behavior (Moawad, 2017), but more research is necessary to determine how educational technology in the form of electronic games affect students' cognitive development.

A better understanding of the developmental appropriateness of educational technology is important. This understanding is supported by Hatzigianni and Kalaizidis (2018), who found the early learning years to be essential for all parts of development, and the early-childhood educator's role imperative. Additionally, researchers have recently refocused their attention from the appropriateness of educational technology in early-childhood pedagogy, to how to best integrate educational technology into early-childhood classrooms (Masoumi, 2015; Nikolopoulou & Gialamas, 2009). Furthermore, different teaching philosophies lend themselves to different opinions about educational technology use in the classroom setting. As a result, it is crucial for early-childhood teachers to feel confident in their lessons, making sure to provide students with effective, developmentally appropriate, and safe learning environments, while successfully monitoring screen time and still adhering to the socio-cultural experiences and

environmental acceptance of 21st century technology (Blake et al., 2011; Smith et al., 2014).

Significance of the Study

Digital technology devices are not passive tools, but rather prominent tools of the 21st century. Each device backs a field of cognitive preoccupations and habits of thinking (Cavanaugh et al., 2016). Past findings of early-childhood technology use are positive for language and vocabulary acquisition (Bedford, Saez de Urabain, Cheung, Karmiloff-Smith, & Smith, 2016; Radesky, Silverstein, Zuckerman, & Christakis, 2014); however, more research is necessary to ease the worry of those who feel technology hinders very young children's cognitive development (Bedford et al., 2016; O'Connor & Fotakopoulou, 2016). By creating developmentally appropriate educational technology activities in the early-childhood classroom, early-childhood teachers can provide various positive learning experiences for early-childhood students (Keenfwe & Onchwari, 2009). Furthermore, the use of educational technology as a developmentally appropriate teaching method can be influenced by early-childhood teachers' confidence levels, values, and norms (Moawab, 2017; Masoumi, 2015). When implemented into the curriculum with confidence, educational technology can be a valuable tool in early-childhood classrooms, and successful implementation of educational technology falls on early-childhood teachers' shoulders (Nikolopoulou & Gialamas, 2009). Early-childhood teachers require more guidance on how to confidently use educational technology in order to fully reap the pedological benefits in their teaching practices (Masoumi, 2015). Investigating teachers' perceptions, attitudes, and technology proficiency of educational technology is one step in creating effective professional development training for early-childhood teachers (Nikolopoulou & Gialamas, 2009), and ensuring effective utilization

of educational technology in terms of learning potentials and district investments (Masoumi, 2015).

Research Purpose and Questions

The purpose of this study was to investigate the influence of early-childhood teachers' perceptions, attitudes, and technology proficiency on educational technology use in early-childhood classrooms. The following research questions guided this study:

Q1: Does early-childhood teachers' years of service influence early-childhood teachers' technology proficiency?

Q2: Does early-childhood teachers' years of service influence early-childhood teachers' attitudes towards technology?

Q3: Is there a statistically significant relationship between early-childhood teachers' technology proficiency and early-childhood teachers' attitudes towards technology?

Q4: What are the perceptions of early-childhood teachers about the use and developmental appropriateness of educational technology in early-childhood classrooms as it relates to their years of service?

Definition of Key Terms

The following are definitions of the key terms used throughout this study.

Developmentally Appropriate Practices (DAP) – perceived theoretical practices deemed as age appropriate for early-childhood settings (Blake et al., 2011).

Early-childhood (EC) – children from birth to six years old (Sheridan, Harding, Meldon-Smith, & Sheridan, 1999). For the purpose of this study, early-childhood refers to students from pre-school (4 years of age) to first grade (6 years of age).

Early-childhood teachers – teachers of early-childhood students (Sheridan, Harding, Meldon-Smith, & Sheridan, 1999).

Early-childhood teachers' years of service – For the purpose of this study, years of service will include all years of experience in an educational classroom (EC – 12th grade).

Educational technology – is the practice and facilitation of learning by creating, using, and managing appropriate technological processes and resources to improve performance (Association for Educational Communications and Technology (AECT), 2004).

Teachers' technology proficiency – teachers are more likely to implement educational technology if they have attained success with past computer use and therefore show technology proficiency (Abbitt, 2011).

Conclusion

This chapter provided an overview for the significance of the problem, the purpose of the research, and key definitions of necessary terms related to this study. The research of this study sought to determine the influence of early-childhood teachers' perceptions, attitudes, and technology proficiency on educational technology use in early-childhood classrooms. The next chapter will provide a detailed literature review of foundational topics incorporated within this study.

CHAPTER II:

REVIEW OF THE LITERATURE

The 21st century has catapulted the world into an age of technology. Digital technology has proven to be an addictive presence in the lives of 21st century (millennial) students (Cavanaugh et al., 2016); changing the way children play, study, and think (Cavanaugh et al., 2016; Moawad, 2017). As a result, it is imperative to find balance between the use of traditional teaching methods and educational technology, and to provide teachers with effective ways to implement educational technology in early-childhood classrooms. The purpose of this study was to investigate the influence of early-childhood teachers' perceptions, attitudes, and technology proficiency on educational technology use in early-childhood classrooms. To address these areas, this literature review will focus on: (a) teachers' technology proficiency and educational technology, (b) teachers' attitudes and educational technology, and (c) teachers' perceptions of DAP and educational technology

Teacher Technology Proficiency and Educational Technology

One measure of teachers' likelihood to implement educational technology into an early-childhood classroom stems from the teachers' technology proficiency. According to Abbitt (2011), experiences lead to success and competence or proficiency, which lead to self-efficacy, if the experiences are authentic. Additionally, self-efficacy influences behaviors such as actions, asserted effort, duration, and passion about the results of a given task and in the field of education, self-efficacy regarding educational technology may critically impact what technology teachers implement into daily practices (Hsu, 2016; Abbitt, 2011). The likelihood of success can aso reflect the amount of energy exerted into a task or goal. Therefore, early-childhood teachers are more likely to implement educational technology if they have attained success with past computer use

and as a result show technology proficiency (Abbitt, 2011). A lack of technology proficiency can alter the effectiveness of educational technology in early-childhood classroom settings, as integrating educational technology is a huge challenge for today's early-childhood teachers (Kent & Giles, 2017).

Prior research shows a direct correlation between teachers' self-efficacy and the implementation of educational technology in a classroom setting (Abbitt, 2011). In other words, self-efficacy derives early-childhood teachers' beliefs about their capabilities to implement educational technology successfully as opposed to their actual technology knowledge (Hsu, 2016). As a result, teacher computer self-efficacy is an important aspect of successful educational technology implementation in early-childhood classrooms.

A compelling research study conducted by Jason Abbitt (2011) focused on the relationship between pre-service teachers' perceived knowledge and self-efficacy beliefs regarding successful implementation of educational technology in a classroom setting. Participants included 45 pre-service teachers enrolled in an early-childhood preparation class. A single-group, pretest-posttest design was implemented to evaluate changes in the relationship between self-efficacy beliefs toward technology integration (SE-TI) and perceived knowledge in Technological Pedagogical Content Knowledge (TPACK) over the course of a semester. A Pearson Product-Moment correlation was used to analyze data between SE-TI and the TPACK sub-scales for both the pretest and posttest. The findings indicated knowledge in TPACK domains strongly correlate to self-efficacy beliefs about classroom technology use. As a result, the findings of this study support the importance of teacher computer self-efficacy when implementing educational technology in early-childhood classrooms.

In a qualitative study by Tweed (2013), the researcher sought to identify factors pertaining to the implementation of technology in educational classrooms. The study

analyzed constructs including age of the teacher, years of teaching experience, quality of professional development, and teacher self-efficacy (technology proficiency) to determine the influence of the constructs on technology integration. A sample of 124 teachers from two different school districts in East Tennessee were solicited for participation. Participants completed an online survey distributed by principals to kindergarten through fifth grade teachers, and data were analyzed based on responses. Findings from this study revealed teacher age, years of teaching experience, teacher gender, and technology professional development hours did not have a statistically significant influence on teachers' self-efficacy. Additionally, teacher age, years of teaching experience, teacher gender, and technology professional development hours did not significantly influence teachers' classroom technology use; however, teachers' self-efficacy was significantly positively related to classroom technology use. This study shows the importance of early-childhood teachers' technology proficiency beyond consideration of experience, gender, and hours of professional development.

Likewise, the purpose of a mixed-methods study conducted by Hsu (2016) was to examine beliefs, practices, and barriers of integrating educational technology in kindergarten through sixth grade classrooms. A sample of 152 teachers with various experience in the midwestern United States participated in online surveys consisting of 22 open-ended questions, following the design of McCrory's framework for integrating technology for high-level learning and validated by numerous researchers and teachers alike. In addition, interviews and observations were conducted with 8 of the 152 teachers. Findings revealed most teachers with constructivist pedagogical beliefs about educational technology also had high self-efficacy beliefs about technology use, indicating more consistent and effective implementation of educational technology by teachers with strong self-efficacy beliefs about educational technology use through student-centered

activities. Barriers to technology integration included lack of computer skills, lack of technology training, lack of time for technology-integrated lessons, and lack of technical support were also revealed, suggesting the need for professional development tailored to teachers' needs.

Another study conducted by Kent and Giles (2017), also investigated self-efficacy as a determinate of technology proficiency. The purpose of this study was to investigate elementary pre-service teachers' self-efficacy beliefs regarding instructional technology. The Moore-Hayes (2011) five-item Likert-type survey measuring self-efficacy for technology integration was completed by 62 elementary pre-service teachers. Participants from the first phase of the study consisted of 28 preservice teachers at a doctoral/research intensive university, who previously completed a course designed to teach how to integrate meaningful technology tools in early-childhood classrooms. The second phase conducted one year later, consisted of 35 pre-service teachers who attended the same university and completed the same technology course. Results indicated a moderately high level of technological efficacy overall. A vast majority (91%) of participants indicated they incorporate educational technology into lessons and 95% reported some confidence in their ability to select and utilize educational technology in teaching. This study indicates the importance of teacher technology proficiency on effective implementation of educational technology in early-childhood classrooms.

Keengwe and Onchwari (2009) focused on practicing teachers. The purpose of their study was to stimulate reflections on the need to adopt a suitable technology integration professional development model in early-childhood classrooms to support young learners. The researchers facilitated an eight-week Summer Institute project in a medium sized Midwest public university, affording participants opportunities to interact with various strategies and tools consistent with constructivist pedagogy. A total of 12

teachers participated in the institute and were rewarded with three credits toward their graduate education. Teachers completed various technology-based projects designed to mirror real classroom activities. Throughout the process, teachers were encouraged to compare their work and critique colleagues' projects to foster growth in successfully integrating technology into instruction and enhancing student learning. While teachers initially reported comfort in integrating basic technology applications, they also revealed a lack of effective skills necessary to consistently implement more difficult tools needed to manage teaching 21st century learners. Participants indicated a need for schools to provide clear direction and support to meet technology goals. This study discovered a need to motivate, train, and equip educators with skills needed to enhance learning through appropriate integration of educational technology in early-childhood classrooms.

In another study, Altun (2019) sought to understand the contribution of technology attitudes and usage, digital literacy skills, and online reading comprehension strategies to pre-service early-childhood teachers' TPACK score. The participants of the study consisted of 481 (398 females and 83 males) volunteer pre-service early-childhood teachers from two state universities in Central Anatolia, Turkey. Participants were selected through a convenience sampling method and data were collected using a cross-sectional survey during the 2017-2018 school year. A total of 481 survey responses out of 600 were returned and analyzed using the TPACK-Deep, digital literacy skills, online reading comprehension strategies, and demographic information. The results determined pre-service teachers' TPACK competencies were associated with their technology attitude and usage, digital literacy skills, and online reading comprehension strategies; however, grade-level and GPA did not factor into their TPACK score. These findings indicate a need to help early-childhood teachers refine their theoretical knowledge and practice in their educational technology integration.

Belo, McKenney, Voogt, Bradley (2016) conducted a comprehensive literature review to describe the knowledge and skills teachers need for using technology to foster early literacy development in kindergarten classrooms. The sample consisted of 46 articles, including studies on electronic storybooks, computer-based phonics, and vocabulary training programs. Data from the study were collected using two reviews, Lankshear and Knobel (2003) and Plowman and Stephen (2003), as a point of departure for defining the search and selection procedures. Selection procedures focused on both relevance and publication year and were categorized according to the four stands distinguished in the targets of the kindergarten early literacy curriculum. From there researchers determined the quality and effectiveness of the educational technology programs in an effort to guide early-childhood teachers through the selection process for implementation. This study revealed the importance of teachers' technology proficiency, which is imperative when selecting quality educational technology programs for integration in early-childhood classrooms.

Understanding early-childhood teachers' technology proficiency and attitudes about educational technology provide insight into its likelihood of future implementation in the early-childhood classroom (Abbitt, 2011). In addition, positive teacher-efficacy in technology proficiency is essential for effective educational technology integration in early-childhood classrooms (Kent & Giles, 2017). As a result, there is a need to adopt quality professional development sessions to support early-childhood teachers' technology proficiency and increase their efforts to successfully implement educational technology in early-childhood classrooms (Keengwe & Onchwari, 2009).

Teacher Attitudes and Educational Technology

Educational technology is constantly changing and evolving, fueling the growth of the 21st century society (Masoumi, 2015). As a result, it is important to investigate the

attitudes and beliefs of teachers towards implementation of educational technology in early-childhood classrooms. A vast majority of early-childhood teachers possess a positive attitude towards using educational technology, which can foster successful implementation of educational technology into pedagogical curriculum (Mertala, 2016). Technology use has become the norm in educational settings, including early-childhood classrooms (Cavanaugh et al., 2016) and how the teachers' attitudes played a role in the success (Mertala, 2017). Furthermore, teachers must perceive educational technology as valuable, or they will be unwilling or unable to implement it successfully (Nikolopoulou & Gialamas, 2010).

As early as 1991, Kulik and Kulik conducted a meta-analysis from 254 controlled evaluation studies. The purpose of the study was to determine the effectiveness of computer-based instruction (CBI) in educational settings. The studies considered for use in the meta-analysis came from three major sources. The first group of studies was obtained from the researchers' earlier meta-analytical reviews on CBI. The second group came from two library database sources, Comprehensive Dissertation Abstracts and ERIC, an Educational Resources Information Center. Finally, the third group of studies was acquired from the bibliographies of the previous groups. The instructional outcome measured student learning throughout all 254 studies, specifically analyzing achievement on examinations, attitude towards computers, attitude towards instruction, attitude towards school subjects, course completion, and amount of time needed for instruction. Outcomes were expressed on a common scale of measurement, using a transformation protocol recommended by Glass, McGaw, and Smith (1981). Outcomes were coded by effect size (ES), defined as the difference between the mean scores of two groups, divided by the standard deviation of the control group. A total of nine variables were finalized based on evidence relevant to the effectiveness of CBI in previous meta-

analyses. Results indicated, out of 248 studies reporting on examinations, 202 (81%) reported students in CBI classes had a higher examination average, while 46 (19%) reported the conventionally taught classes as having a higher average. Additionally, the difference in performance of CBI and control students was significant in 100 of the studies. In 94 of the 100 cases, the significant difference was greater in the CBI classes. The results showed 62% of average students in CBI classes outperformed students from conventional classes. This study showed how a compilation of results from numerous studies revealed benefits of using educational technology in classrooms.

An informative study conducted by Hatzigianni and Kalaitzidis (2018), reported on early-childhood educators' attitudes and beliefs on use of touch-screen technologies by students under the age of three. A sample of 203 early-childhood educators and directors, who worked with infants and/or toddlers in Australia, participated in a detailed online survey. Focus groups consisting of 21 educators and 7 directors were also evaluated with a semi-structured interview guide, to provide more elaboration on their views. The findings revealed a changing trend in teachers' attitudes on the use of educational technology by young children. Teachers in the study were more confident in their personal use of technology and were open to change; however, felt more research is needed detailing the effects of educational technology on developmental properties in young children's brains to ensure proper implementation within early-childhood classrooms This study supported the necessity of more training to cultivate stronger beliefs for early-childhood teachers to implement educational technology with early-childhood students.

In an exploratory study by Seraji, Ziabari, and Rokni (2017), researchers aimed to find the relationship between teachers' tenure (years of service), age, educational level, experience, and teachers' attitude toward technology. A total of 100 teachers working in

several language institutes in Mazandaran completed the *Attitude Technology Survey* consisting of teachers' attitudes towards technology and teachers' use of technology. Data were analyzed using the non-parametric Spearman Rank-Order Correlation to find the relationship between the variables. Findings of the research questions indicated a statistically significant relationship between three constructs, including teachers' tenure, experience, and age regarding teachers' attitudes towards technology. This study highlighted the link between years of experience and teachers' attitudes towards technology implementation.

In another study, Nikolopoulou and Gialamas (2010) investigated the difference between pre-service (zero years of service) and in-service (various years of service) teachers' views (attitudes) and intentions about integrating educational technology in early-childhood settings. The study's sample consisted of 240 in-service kindergarten teachers from Athens, Greece, and 428 pre-service teachers studying early-childhood education at the University of Athens. A two-section survey was used to determine demographics, computer self-efficacy, attitude, and intent of participants to use computers in their classroom. Results showed a strong correlation between teachers' attitudes and their intention of using educational technology in the classroom. While in-service teachers expressed more positive views or intentions of technology use and pre-service teachers reported significantly higher computer self-efficacy and prior experience in computer use, there was not enough evidence present to compare in-service teachers' and pre-service teachers' views concerning educational technology use in early-childhood classrooms. These findings reaffirmed the importance of teachers' attitudes and beliefs on the implementation of educational technology in early-childhood classrooms.

While investigating the influence of a paired grouping method in undergraduate studies, Giles (2016) focused on participants' perceived attitudes, proficiency, and technological knowledge in technology use. A sample of 83 student participants was taken from a pool of students enrolled in a required educational technology course. Participants answered questions on a combination of three surveys, and 24 of the sampled students participated in semi-structured interviews. Results indicated a positive correlation of participants' perceived attitudes, proficiency, and technological knowledge on their intentions to use educational technology in future classrooms. The study also showed a positive influence of paired grouping teaching methods on attitudes, proficiency, and technological knowledge. Findings in this study highlight both the importance of overall attitudes towards educational technology use and proper training methods for all teachers.

In another study, Yilmaz and Alici (2011) also examined pre-service teachers' attitudes towards technology. The purpose of the study was to investigate pre-service early-childhood teachers' attitudes towards using Computer Based Education (CBE) while implementing science activities. The effect of different variables such as gender, year in program, experience in preschool, owning a computer, and the frequency of computer usage was also measured to determine how they affected pre-service early-childhood teachers' attitudes towards using CBE while teaching science. A population of 215 freshmen and senior early-childhood teacher candidates attending state universities in Ankara was acquired and from the population, a sample of 58 participants was established. The study was designed as a survey research method using *Demographical Questionnaire* developed by the researchers and *The Scale of Attitude toward Computer Based Education*. The data were then analyzed using t-tests and ANOVA to determine the effect of independent variables on CBE attitudes. Results indicated participants

indicated overall positive attitudes towards CBE while implementing science instruction as shown by a mean score of 69.97. This could be attributed to training and experiences received through university education. Additionally, the study indicated variables such as gender, owning a computer, and frequency of computer use did not effect on pre-service early-childhood teachers' implementation of CBE in science instruction. This study confirms the importance of training and exposure on early-childhood teachers' attitudes towards educational technology usage in early-childhood classrooms.

Preradovic' and Boras (2017) aimed to reveal educators' understanding of the potential of information and communication technology (ICT). The purpose of this study was to analyze the role and attitudes of kindergarten educators on ICT in education. A survey instrument developed by coordination of both early-childhood education experts and an ICT expert was distributed to educators from a public kindergarten, which housed 486 students and 85 educators during the 2014-2015 school year. Survey respondents included 46 female educators from the school under study. Participants answered 11 survey questions measuring educators' perceptions and attitudes containing independent variables (how often, for what purposes, and where educators used computers and the Internet) and dependent variables (attitude of educators on introducing ICT to children in the early age in relation to their preferences for using computers, the Internet, and ICT in general). Results found a large percentage of participants (86.67%) possess some sort of technology. In addition, 42 of the educators (57.14%) use technology several times a week, and most use computers at home rather than at work. These results indicate a general computer literacy of educators in the study. Participants' attitudes showed a moderately positive attitude to introducing and using educational technology in the classroom (93%), while 37% recognized the potential danger of developed dependence.

Overall educators support the use of ICT by young children and frequently use computers in classroom settings.

Additionally, a study conducted by Kara and Cagiltay (2017), targeted in-service teachers. The purpose of the study was to gain an understanding of in-service preschool teachers' thoughts about technology use in early educational settings. Semi-structured one-on-one interviews were conducted with 18 conveniently selected in-service preschool teachers from both public and private school settings. Based on the implemented content analysis technique, eleven main themes as to technology related views and practices emerged. Results found while teachers are aware of both advantages and disadvantages of technology use in preschool classrooms, they choose to focus on the advantages. These results indicated an overall positive attitude towards technology use, giving importance to appropriate guidance from teachers and parents. Teachers expect support from both curriculum and schools on using technology for children in an appropriate way. In addition, most of the teachers stated there was a need for professional development courses of advanced technology use. Furthermore, a need to consider preschool teachers' desires and expectations in technology integrations was revealed.

Magen-Nagar and Firstater (2018) conducted a study with the purpose of identifying obstacles to information and communication technology (ICT) implementation in the kindergarten environment through exploring beliefs of kindergarten teachers. Study participants included 30 kindergarten teachers (25 general education and five special education) working under the supervision of the Ministry of Education in Israel. The average years of service was 14.7 years, and most held only a bachelor's degree. Convenience sampling was used to select the sample who participated in semi-structured interviews. Content analysis revealed three main obstacle-related categories: 1) pedagogically, despite acknowledgement of its value, ICT does not play a

key role in the kindergarten teachers' education philosophy, 2) didactically, ICT is used mainly as a source of information and for instructional illustration, rather than as a means to new teaching strategies, and 3) developmentally, computer use affects children's social development, especially those with special needs, but not always positively. Results indicated a more passive role of the computer in the kindergarten classroom. Although they see the value, it is not given a key role in the curriculum. In addition, most teachers use the computer during free-play hours (beginning and end of the day), not realizing the pedagogical potential of ICT in kindergarten. Teachers' perspectives on the developmental contribution of ICT were inconclusive, especially for children with special needs. Finally, kindergarten teachers neither overcome these obstacles nor operate ICT to its fullest potential. As a result, teachers should be encouraged to participate in professional training to develop skills needed to reduce obstacles to implementing ICT in kindergarten classrooms.

Teachers' philosophies can directly influence how technology is integrated in classrooms (Hatzigianni & Kalaitzidis, 2019), and computers can serve as valuable learning tools when implemented in a pedagogically appropriate manner (Nikolopoulou & Gialamas, 2009). In addition, teachers' attitudes about the role of educational technology influences their pedagogical reasoning and behavior, often limiting their efforts to implement educational technology into classroom activities (Nikolopoulou & Gialamas, 2009). Therefore, early-childhood teachers must keep a positive attitude and believe in what they implement into classroom settings. However, attitude is not the only factor which influences implementation of educational technology in early-childhood classrooms.

Teacher Perceptions of DAP and Educational Technology

In addition to attitudes and proficiency about educational technology use in early-childhood classrooms, perceptions of appropriate practices also influence how educational technology use is implemented. Early-childhood teachers have traditionally relied on research-based practices developed by theorists such as Piaget and Vygotsky; however, technology has caused educators to question outdated philosophies, complicating the blend of both research-based and trending teaching practices (Blake et al., 2011). This section will discuss how teachers' perceptions of early-childhood philosophies, such as Developmentally Appropriate Practices (DAP) impact use of educational technology in early-childhood classrooms. Early-childhood teachers hold a massive responsibility as the first primary teacher students encounter (Hatzigianni & Kalaitzidis, 2018). Additionally, the way educational technology is used in early-childhood classrooms largely depends on teachers' perceptions about its effectiveness (Masoumi, 2015).

Blake, Winsor, Burkett, and Allen (2011) conducted a study of DAP in early-childhood settings, stemming from an interpretation of Piaget's theories of development. It focused on answering the question: "What technology tools are considered age appropriate for very young and young children?" (p. 37). The sample consisted of two self-selected groups of 28 professionals (early-childhood and instructional technology) who responded to an online survey. The survey consisted of different types of technology and a rating scale evaluating which age range (very young children, young children, elementary, middle school, and high school) should use the proposed technology. Results suggested less than 20% of the professionals considered technology use appropriate for children ages 2-8 (early-childhood). These findings are important to the discovery of how

teachers' perceptions of educational technology influence implementation in early-childhood classrooms.

In a more recent study, Smith et al. (2014) recruited 88 early-childhood pre-service teachers from a large university in the southwestern United States to participate in a mixed-methods study. The purpose of the study was to identify the current state of pre-service teachers' knowledge and attitudes towards technology integration in early-childhood classrooms. In addition, a follow-up focus group examined the impact of teaching foundational skills (DAP) without formal technology training. Participants answered survey questions designed by the research team, consisting of 35 quantitative and qualitative questions (30 Likert scale and five open-ended) and all 88 pre-service teachers also participated in the focus group. Quantitative data were analyzed using descriptive strategical procedures involving one-way tables and cross-tabulations and qualitative data were coded for further analysis. Results indicated many pre-service teachers are not prepared to understand intricate relationships between DAP and technology integration, resulting in developmentally appropriate educational technology integration strategies. Although most participants felt confident with personal technology skills and felt overall positive attitudes towards technology integration, many did not feel prepared to successfully transfer personal skills into future classroom environments. This study confirms the need for strong DAP knowledge and training needed for successful educational technology integration in early-childhood classrooms.

To bring clarity to a complex subject, Masoumi (2015) conducted a case study aimed at identifying ways in which educational technology is integrated into southwestern Sweden pre-schools. This study addressed teachers' perceptions of how information and communication technologies (ICT) can influence existing early-childhood practices. Interviews were conducted with 12 pre-school teachers from six

different schools (two from each school). Semi-structured interviews fostered discussions on teachers' thoughts and experiences with using ICT in everyday routines. Findings suggested mixed perceptions of how educational technology should be implemented in early-childhood settings. While some teachers viewed educational technology as an enhancement to already established pedagogical practices, others took stances on the inappropriateness of educational technology in early-childhood classrooms. This study reinforces the importance of teachers' perceptions on the successful implementation of educational technology in early-childhood practices and routines.

Pepper (2014) examined early-childhood professionals' observations of the many changes in the education of young children, particularly in kindergarten. The purpose of this study was to assess North Mississippi kindergarten teachers' evolving views in an environment of testing and accountability. The researcher surveyed 140 kindergarten teachers across the North Mississippi Education Consortium (NMEC), using the *Primary Teacher Questionnaire: A Teacher Beliefs Scale Based on the NAEYC Guidelines for Developmentally Appropriate Practice in the Primary Grades (PTQ)*. The PTQ is a 50-item survey containing demographic questions and questions concerning the teachers' views of DAP. Data in this study were analyzed using cross tabulation to develop a profile of kindergarten teachers in North Mississippi. The findings from the study revealed NMEC kindergarten teachers' wide acceptance of a child-centered teaching philosophies. Additionally, the survey measured kindergarten teachers' perceptions of curriculum, instruction, and children's growth and development. Despite high curricular demands, data showed teachers supported DAP, regardless of their levels of education or years of teaching experience. This study reiterated the importance of DAP in early-childhood curriculum.

Another important study examined how educational technology can be used in a developmentally appropriate manner was conducted by Beschorner and Hutchison (2013). The qualitative case study was used to describe the use of iPads in two pre-school classrooms over a seven-week period. Students in the study attended Independence Pre-school (IPS), a midwestern non-profit pre-school serving 95 students, ranging in age between 3 and 5 years old. Data were collected twice weekly through students' digital work samples, semi-structured teacher interviews, parent emails, and an informal parent survey. The results of the study found iPads could be used to support teaching of emergent literacy through creative practices within the early-childhood classroom. As a result, this study supported findings of educational technology enhancing student learning but not compromising developmentally appropriate practices.

Mertala (2017) conducted a small study to explore the relationship between pre-school educators' attitudes about educational technology and their pedagogical beliefs. The sample of seventeen educators was established from four pre-school groups participating in a development project. Interviews were conducted during work hours at the project site and were either audiotaped or videotaped. Results found teachers' attitudes about educational technology to be positive, if the technology supported the main teaching methods used in the development of academic skills. Findings from this study reinforce the importance of correlating teachers' beliefs with developmentally appropriate practices, which foster positive attitudes about implementing educational technology.

A study conducted by Tondeur, De Bruyne, Van Den Driessche, and Zandvliet (2015) examined the physical placement of educational technology in the classroom. The purpose of the study was to gain deeper insights into how educational technology streamlines the classroom as a spatial setting and how the positioning of the technologies

can be related to educational practices. The research included photographic and schematic representations of 115 classrooms in 12 primary schools in Belgium, resulting in a typology based on structural features. From the structures, nine teachers were purposefully selected and interviewed regarding the link between classroom layout and educational technology use. The first phase of analysis synthesized data from each teacher and a vertical analysis was applied. In the second phase, results of the vertical analysis of each school were submitted to a cross-site analysis, where data were systematically compared for similarities and differences. The results indicated, 1) specific types of educational technology use correlated to its position in the classroom, 2) the classroom layout is in transition to include multiple screens, and 3) the educational practice of individual classes is dispersed over different locations within the school. Findings of this study conclude the physical location of educational technology in early-childhood classrooms mediates their pedagogical usage.

Moawad (2017), aimed to investigate the effects of tablet-based electronic games on children's self-concept. A total of 26 children (17 girls and nine boys) and their mothers were recruited from Alnahda Women's Organization in Riyadh, Saudi Arabia. All participants were from low-income backgrounds and did not possess any electronic games. Children were equally divided into one control group and one experimental group, based on IQ scores to ensure IQ differences would not be a factor. The Self Concept Test developed by Ibrhem Gashgosh was used to evaluate each child's self-concept and the Goodenough Draw-A-Person Test was used to measure participants' IQ. A Mann-Whitney test was administered to verify the equivalence of the two groups' self-concept pre-test scores. The results showed no significant group differences. Additionally, the Wilcoxon test was applied to the pre-post total scores and to each domain of the self-concept test to see if children's self-concept increased after playing

with electronic tablet games. The results for the pre- to post-test differences were not significant for the experimental group. For the control group, only one domain, curiosity, showed a significant difference with 13 children demonstrating increased curiosity. As a result, this study shows educational technology games do not affect early-childhood students' self-concept, as it pertains to a developmentally appropriate practice.

Past research indicated, it is necessary to teach phonological awareness foundations, as a developmentally appropriate practice, because without them, students struggle with reading and writing (Alghazo & Al-Hilawani, 2010). Phonological awareness foundations result in the ability to process sounds needed for proficient literacy skills. It encompasses phoneme awareness, the ability to manipulate sounds in words, and basic phonological skills, such as identifying rhyming words (Anthony & Francis, 2005).

In a study conducted by Alghazo and Al-Hilawani (2010) 83 female kindergarten teachers were sampled from a population of public-school teachers in the United Arab Emirates. To examine differences in phonological awareness (PA) knowledge, skills, and practices of early-childhood education teachers, two different methods were used to collect data. The first method utilized a two-part survey gathering information on demographics, knowledge of PA, and PA skills. As a second method, observations were conducted to verify whether self-reported skills were demonstrated in classroom practices. Results showed a significant difference between knowledge and practices domains, knowledge and skills domains, and skills and practice domains. In addition, the study showed in-service training had the greatest influence on observed classroom practices. These findings expose a need for in-service training to help reinforce the skills and practices needed to teach effective phonological awareness lessons in early-childhood classrooms.

In another study McKinley (2014) conducted a study to determine if relationships existed between faculty demographics, such as age, gender, tenure (years of service), and overall attitude toward technology. Additionally, the study examined the implementation of technology into classroom instruction. A sample comprised of 103 volunteer respondents at 3 midsized rural high schools was solicited to complete the *Levels of Technology Implementation* survey, including five additional validated questions about attitude towards technology. A Pearson's correlation coefficients (r), independent samples t-tests, ANOVAs, and ANCOVAs were used to analyze the data. Findings indicated a general deficiency in technology implementation in classroom instruction. No significant relationships between faculty demographics and technology implementation existed, but attitude toward technology was significant when implementing educational technology into curriculum. As a result, a professional development program intended to increase the impact on how learning is transferred through technology was created. This study reinforces the importance of quality training for all teachers, despite tenure or years of service.

Pedagogical beliefs typically included two different dimensions: traditional/teacher-centered and constructivist/student-centered where classroom reality is often a mix of both (Mertala, 2017). In addition, research regarding early-childhood education and educational technology has shifted its aim to focus on the most effective strategies for implementing educational technology in a developmentally appropriate manner (Masoumi, 2015). As a result, it is important to improve professional development and guidance if early-childhood teachers are to recognize where educational technology fits into DAP and develop necessary skills for effective implementation of educational technology in early-childhood classrooms (Parette et al., 2009).

Summary of Findings

All studies reviewed in this chapter provided insights in teachers' perceptions, attitudes/beliefs, and self-efficacy towards use of educational technology in early-childhood classrooms. Research included in this chapter indicated most educators need more proof to support educational technology as a DAP in early childhood (Blake et al., 2011). Additionally, evidence showed it is reasonable to expect attitudes to affect the way educators use educational technology in their classrooms (Abbitt, 2011). Furthermore, Hatzigianni and Kalaitzidis (2018), provided evidence showing teacher computer self-efficacy impacts the way educational technology is implemented in the classroom setting. These findings warrant more investigation in teachers' attitudes and technology proficiency regarding the use of educational technology, and perceptions to better support the implementation of educational technology in early-childhood classrooms.

Theoretical Framework

The theoretical framework for this study is based on the foundations of three theorists. As previously mentioned, perceptions, attitudes, and beliefs about early-childhood practices were developed in part by theorists such as Piaget, Vygotsky, and Bandura. Aspects of these theories are reviewed in this section. While there are several theories surrounding the need for developmentally appropriate practices, Piaget's theory of cognitive development is the main catalyst (Blake et al., 2011). Understanding the cognitive development of early-childhood students, through the study of the human brain, has gleaned important knowledge necessary for improving educational practices. For example, research in cognitive development has revealed the importance of phonological awareness in reading foundations (Siegler, 2016).

Stage theories, such as Piaget's, focused on whether children achieve different stages of cognitive development during the learning process (Siegler, 2016). Piaget's

theory centered around four fixed stages. In each stage children reason and solve problems about the world around them in similar but fundamental ways (Siegler, 2016). The four stages included the sensorimotor stage (birth - 2 years), the preoperational reasoning stage (2 years - 6/7 years), the concrete operational reasoning stage (6/7 years – 11/12 years), and the formal operational reasoning stage (11/12 years - throughout the rest of life) (Siegler, 2016).

According to Piaget's theory, early-childhood students function in either the sensorimotor stage, or preoperational reasoning stage of cognitive development. During the sensorimotor stage, children's mental representations are very limited, and cognitive learning is grasped through their established schema and physical interactions with the world around them (Siegler, 2016). During the preoperational stage, children can show a vast range of symbolic-representation capabilities, such as drawing and using language; however, most early-childhood students in this stage focus on single dimensions rather than solving problems from a multi-dimensional perspective (Siegler, 2016). As a result, developmentally appropriate practices should adhere to the cognitive development skills found within these two stages (Blake et al., 2011). According to Vygotsky, early-childhood students learn through social interactions with peers and adults. Children are guided to discover new things and supported by scaffolding concepts along the way. As a result, their learning increases cognitive development (Sharkins, Newton, Causey, & Ernest, 2017).

Vygotsky's sociocultural theory was based on how attitudes, values, and beliefs of the surrounding culture influence early-childhood students' learning development (Siegler, 2016). In addition, teachers' attitudes towards educational technology are strongly influenced by proven practices (Parette et al., 2009). Therefore, one can correlate

teachers' attitudes and beliefs to the success of educational technology in early-childhood students' learning development.

Albert Bandura studied the theory of self-efficacy, believing one's self-efficacy would affect the output of any given task. According to Bandura (2006), self-efficacy is concerned with people's views of their own abilities to yield given attainments. In addition, self-efficacy of technology proficiency consists of early-childhood teachers' beliefs about what educational technology they are capable of implementing successfully in their classroom (Hsu, 2016), and self-efficacy theory suggests one's belief in the ability to affect the outcome influences both thought and action (Abbitt, 2011). Consequently, early-childhood teachers' self-efficacy of technology proficiency contains indicators of how educational technology is integrated in early-childhood classrooms (Hsu, 2016).

Paiget's theory of cognitive development and Vygotsky's sociocultural theory underlined the importance of implementing developmentally appropriate practices into early-childhood classrooms. In his theory, Vygotsky also stressed how important positive attitudes and social interactions are to learning development. Furthermore, in his theory of self-efficacy, Bandura summarized how beliefs and confidence in the success of one's endeavors, affects the amount of effort extended. Consequently, a combination of each of the theories examined in this section provides a holistic lens through which to view this study.

Conclusion

The information in this chapter provided a foundation to support the study of teachers' perceptions, attitudes, and self-efficacy towards the use of educational technology in early-childhood classrooms. The literature reviewed combined facts and findings from recent research with the theoretical framework established by researchers

of long ago. Additionally, this chapter supported the need for further research on this topic and set the tone for the information in the following chapters. Chapter III will provide the methodological aspects of this study, including the operationalization of theoretical constructs, research purpose and questions, research design, population and sampling selection, data collection procedures, data analysis techniques, privacy and ethical considerations, and research design limitations.

CHAPTER III:

METHODOLOGY

The purpose of this study was to investigate the influence of early-childhood teachers' perceptions, attitudes, and technology proficiency on educational technology use in early-childhood classrooms. The researcher of this mixed methods study collected survey and interview data from a purposeful sample of early-childhood teachers (Pre-K - first grade) in a large suburban school district located in southeast Texas. Quantitative data were collected from the *Technology Proficiency Self-Assessment for 21st Century Learning* (TPSA C21) and the *Attitude Toward Technology Scale* (ATTS). Data from the survey responses were analyzed using frequencies and percentages, while an inductive thematic coding process was used to analyze information collected from participants' interviews. This chapter provides an overview of the research problem, functioning definitions of theoretical constructs, the purpose of the research and corresponding research questions, research design, population and sampling of participants, instrumentation, data collection procedures, data analysis, privacy and ethical considerations, and the limitations of the study.

Overview of the Research Problem

Prior to the structure of 21st century learning, teachers and textbooks provided most of students' educational knowledge, but today technology is a part of daily life, children as young as three years old use technology as a learning tool more than their parents did at their age, and anyone with internet access can obtain information from anywhere in the world (Blake et al., 2011; Ramsey, 2018). Despite such early exposure to technology, many stakeholders believe technology hinders young children's social development (Bedford et al., 2016). Even children's playtime activities have changed dramatically over the past 10 years, due to readily available electronic games on mobile

devices and touch screen tablets. Advances in technology mean technology is easily accessible (Moawad, 2017). Considering the increased exposure to technology, early-childhood teachers are rethinking the role of educational technology in their classrooms (Beschorner & Hutchison, 2013). As a result, early-childhood teachers need guidance to provide developmentally appropriate lessons, while still adhering to the socio-cultural experiences and environmental acceptance of 21st century technology (Blake et al., 2011). Additionally, a more balanced curriculum, could potentially lend itself to future academic success in early-childhood classrooms.

Operationalization of Theoretical Constructs

This study consisted of two constructs: (a) teachers' technology proficiency and (b) teachers' attitudes about technology use. Teachers' technology proficiency is concerned with the teachers' perceptions of their level of competence with computer usage (Gialamas & Nikolopoulou, 2010), and was measured using the TPSA C21. In the second construct, attitude is defined as an individual's beliefs/feelings about the execution of certain behaviors (Ajzen, 1991), and for the purpose of this study refers explicitly to varying technology interactions and was measured using the ATTS.

Research Purpose, Questions, and Hypothesis

The purpose of this study was to investigate the influence of early-childhood teachers' perceptions, attitudes, and technology proficiency on educational technology use in early-childhood classrooms. The following research questions guided this study:

Q1: Does early-childhood teachers' years of service influence early-childhood teachers' technology proficiency?

Ha: Early-childhood teachers' years of service does early-childhood teachers' technology proficiency.

Q2: Does early-childhood teachers' years of service influence early-childhood

teachers' attitudes towards technology?

Ha: Early-childhood teachers' years of service does early-childhood teachers' attitudes towards technology.

Q3: Is there a statistically significant relationship between early-childhood teachers' technology proficiency and early-childhood teachers' attitudes towards technology?

Ha: There is a statistically significant relationship between early-childhood teachers' technology proficiency and early-childhood teachers' attitudes towards technology.

Q4: What are the perceptions of early-childhood teachers about the use and developmental appropriateness of educational technology in early-childhood classrooms as it relates to their years of service?

Research Design

A sequential mixed-methods design (QUAN→qual) was employed for this study. During the quantitative phase, the researcher collected survey data and the qualitative phase included interviews. The in-depth examination of both the quantitative results and qualitative interviews provided a valuable way of conducting thorough research for this study. A purposeful sample of early-childhood teachers teaching grades Pre-Kindergarten through first grade in a large suburban school district located in southeast Texas completed the TPSA C21 and the ATTS. In addition, interviews were conducted with participants to investigate perceptions of early-childhood teachers about the use and developmental appropriateness of educational technology in early-childhood classrooms as it relates to their years of services. Quantitative data were analyzed using frequencies and percentages, while qualitative data were analyzed using an inductive thematic coding process.

Population and Sample

The population of this study consists of a large suburban school district in southeast Texas. This school district is composed of 69 campuses (10 high schools, 16 junior high schools, 42 elementary schools, and one virtual school), employs 10,273 staff members, and has a total student population of 79,710 students (TEA, 2019). Table 3.1 provides the student district demographic data obtained from the 2018-2019 Texas Academic Performance Report.

Table 3.1

District Student Demographic Data

	Frequency (n)	Percentage (%)
African American	8,890	11.2
American Indian	248	0.3
Asian	12,294	15.4
Hispanic	28,238	35.4
Pacific Islander	122	0.2
Two or More Races	2,459	3.1
White	27,459	34.4
Economically Disadvantaged	25,154	31.6
Non-Educationally Disadvantaged	54,556	68.4
English Learners (EL)	13,452	16.9
Student w/ Disciplinary Placements (2017-2018)	401	0.5
At-Risk	31,487	39.5
Students with Disabilities	8,464	10.6

The participating district employs 6,623 professional staff members. Of this staff, 5,274 are teachers (TEA, 2019). The number of teachers on each campus depends on the grade-level range (elementary, junior high school, or high school) and population size.

Table 3.2 shows the district teacher demographics for the participating school district obtained from the 2018-2019 Texas Academic Performance Report. A purposeful sample of early-childhood teachers (Pre-K - first grade) from the population in a large suburban school district located in southeast Texas was solicited to participate in this study. Table 3.3 shows the percent of early-childhood teachers, broken up by grade taught, in comparison to all teachers working in the district

Table 3.2

District Teacher Demographic Data

		Frequency (n)	Percentage (%)
1.	Race/Ethnicity:		
	African American	379	7.2
	American Indian	23	0.4
	Asian	155	2.5
	Hispanic	771	14.6
	Pacific Islander	4	0.1
	Two or More Races	53	1.0
	White	3,890	73.8
2.	Gender:		
	Male	994	18.8
	Female	4,280	81.2
3.	Highest Degree Held:		
	No Degree	5	0.1
	Bachelors	3,875	73.5
	Masters	1,347	25.5
	Doctorate	47	0.9
4.	Years of Experience:		
	Beginning Teachers	262	5.0
	1-5 Years of Experience	1,480	28.1
	6-10 Years of Experience	1,139	21.6
	11-20 Years of Experience	1,601	30.4
	Over 20 Years of Experience	792	15.0

Table 3.3

District Early-childhood Teacher Data

	Frequency (n)	Percentage (%)
Pre-Kindergarten	100	1.9
Kindergarten	247	4.8
First grade	253	4.9
Total	640	12.4

Participant Selection

Early-childhood teachers (Pre-K - 1st grade) from a large school district in southeast Texas were solicited to participate in the qualitative research for this study. All participants were selected from a larger sample established by answering survey questions and agreeing to an interview for further analysis. The response to interview invitations, produced 10 teachers willing to engage in the interview process. Most participants (seven) taught at the same school due to scheduling conveniences.

During the interviews, participants were asked to answer 15 semi-structured interview questions about the type of technology they use in their classrooms, how they choose the programs they use, and how they feel about using technology in an early-childhood classroom. Participants also answered questions about DAP and how the concept of DAP correlates to technology use in early-childhood classrooms. The researcher also examined years of service and early-childhood experience to determine their effect on educational technology usage in the early-childhood classroom.

Instrumentation

Technology Proficiency Self-Assessment for 21st Century Learning

The *Technology Proficiency Self-Assessment for 21st Century Learning* (TPSA C21) is a modified version of the TPSA developed by Ropp (1999). The revision includes two new scales focusing on emergent technology skills (teaching with emerging technologies and emerging technology skills). The survey has teachers specify their perceived competency skills on items such as e-mail, the World Wide Web (WWW), integrated applications, and integrating technology into teaching.

The TPSA C21 instrument utilizes a 34-item survey using a five-point Likert type scale to measure pre-service and in-service teachers' computer skills based on a

technology proficiency checklist and emerging technologies (Christensen, Knezek, Alexander, Owens, Overall, & Mayes, 2015; Ropp, 1999). Responses range from 1= *Strongly Disagree* to 5 = *Strongly Agree*. Composite scores were calculated by totaling the scores for all individual responses, ranging for 34 to 170. Higher composite scores indicated a more positive proficiency with using technology. The TPSA C21 is a confirmed reliable and valid measurement instrument, maintaining reliable estimates ranging from 0.73 to 0.86. The two emerging technology scales yielded Cronbach's Alpha internal consistency reliability estimates of 0.84 to 0.91 (Christensen et al., 2015). For the purpose of this study, the Likert type scale was reduced to 4-points removing "*Undecided*" and thus forcing the participant to agree or disagree. In addition, the composite scores for this survey were adjusted to values ranging from 34 to 136 to account for the smaller scale.

The Attitude Toward Technology Scale

The *Attitude Toward Technology Scale* (ATTS) instrument was established and piloted during an evaluation of the teacher preparation program at the University of

Houston–Clear Lake (UHCL) by Kajs, Underwood, Coppenhaver, Driskell, and Crawford (2001). The purpose of the instrument is to monitor teacher beliefs about technology and how they evolve throughout teacher training. The ATTS does not make a distinction between the software or hardware components; instead, it categorizes them together as technology. Items contained in the survey have teachers express their attitudes towards the influences of technology in working directly with students, as an evaluation tool, as an engagement strategy, and as an organizational or presentation tool for teachers.

The ATTS instrument utilizes a 31-item survey using a five-point Likert type scale to evaluate teacher attitude with technology in the classroom (Kajs et al., 2001). Responses range from 1= *Strongly Disagree* to 5 = *Strongly Agree*. Also included in the

survey were reverse coded items such as "Time spent incorporating technology could be spent teaching the basics" and "Technology distracts from learning". These statements were included to increase the reliability of the survey by confirming consistent responses from participants. Item numbers 3, 5, 8, 11, 19, 20, 24, 25, 26, and 29 were reverse coded to increase response dependability. Composite scores of the responses were calculated with values ranging from 31 to 155. Higher composite scores indicated a more positive attitude about technology use in the classroom. The Cronbach's alpha reliability coefficient was reported to be 0.98 (Kajs et al., 2001). For the purpose of this study, the Likert type scale was reduced to 4-points removing "*Neutral*" and thus forcing the participant to agree or disagree. In addition, the composite scores for this survey were adjusted to values ranging from 31 to 124 to account for the smaller scale.

Data Collection Procedures

Quantitative

Prior to data collection, the researcher gained approval from UHCL's Committee for Protection of Human Subjects (CPHS) and the school district's Institutional Review

Board (IRB). After permission was granted, the researcher solicited the names and email addresses of all district early-childhood (Pre-K–first grade) teachers from the district website. All Pre-K, Kindergarten, and first grade teachers (42 elementary schools) working in a large suburban school district in southeast Texas received an email soliciting participation in the study. In addition to the survey link, the email invitation included the timeline for survey completion, a survey cover letter providing an overview of the study, and instructions regarding the data collection process.

Qualitative

After receiving CPHS approval and district IRB approval, qualitative data were collected through a series of interviews conducted both in person and virtually. Invitations were sent requesting interview participation from district early-childhood teachers who completed the survey. In addition, the email included details such as the approximate duration of the interview (10–15 minutes) and the location. The researcher agreed to meet the interviewee at his/her campus or an agreed upon location. Additionally, all participants' names were changed to maintain anonymity.

The email invitations yielded 10 participants and gathered much needed data to answer the study's qualitative research question. During each interview, the researcher introduced herself upon arrival and offered an overview of the purpose of the study. After a brief summary was provided, the participants signed the informed consent forms and previewed the semi-structured interview questions. Once clarifications were made and the interviewees were settled, the interviews began and were recorded for analysis.

The first interview lasted approximately 10 minutes and was very causal and informative. The participant was honest and forthcoming with information and appeared very interested in the topic. The interview yielded follow-up questions to the semi-structured questions used to clarify answers and glean more depth to initial answers.

Similarly, the remaining interviews provided both informative and honest opinions to the use of educational technology in early-childhood classrooms. The last interview was conducted with a very knowledgeable educator with 22 years of experience teaching in an early-childhood classroom. It was very interesting to learn the opinion of a tenured professional in the field of education.

All data were secured in a password-protected folder on the researcher's computer and in the researcher's office within a locked file cabinet. At the culmination of the study, the researcher will maintain the data for five years, the time required by CPHS and district IRB guidelines. The researcher will destroy the contents of the file once the deadline has expired.

Data Analysis

Quantitative

To answer research questions one and two, a one-way analysis of variance (ANOVA) was conducted using IBM SPSS to determine if early-childhood teachers' years of service influences early-childhood teachers' technology proficiency and/or early-childhood teachers' attitudes towards technology. The independent variable, early-childhood teachers' years of service, was divided into four categorical groups: (a) 0–5 years of service, (b) 6–10 years of service, (c) 11-20 years of service, and (d) more than 20 years of service. The dependent variables, early-childhood teachers' technology proficiency (Q1) and early-childhood teachers' attitudes towards technology (Q2), are continuous variables. Both were measurable composite scores calculated by combining individual responses for both variables. Following initial analysis, a Tukey post hoc multiple comparison test was conducted to compare the mean differences between individual years of service groups and identify the pair(s) of groups with statistically

significant mean differences. Furthermore, effect size was determined using eta-squared and a significance value of .05 will be used for this study.

To answer question 3, a Pearson's product moment correlation (r) was conducted using IBM SPSS to determine if there is a relationship between early-childhood teachers' technology proficiency and early-childhood teachers' attitudes towards technology. Effect size was measured using the coefficient of determination (r^2) and a significance value of .05 will be used for this study. Variables in this question (Q3) were continuous in measurement. Early-childhood teachers' technology proficiency and early-childhood teachers' attitudes towards technology were measurable composite scores calculated by combining individual responses for both variables.

Qualitative

The researcher used the following research question to derive the qualitative portion of this mixed-methods study.

> Q4: What are the perceptions of early-childhood teachers about the use and developmental appropriateness of educational technology in early-childhood classrooms as it relates to their years of service?

To answer the research question, thematic analysis was selected as the method of organizing responses to the interviews. All data were transcribed using audio recordings collected at the time of the interviews. The interviews were transcribed and analyzed for themes developed through answers to questions and dialogue shared throughout each conversation. Each interviewed was compared to previous interviews to look for patterns and/or themes produced during responses. After transcribing each interview, data supporting the existing themes, as well as new themes emerged. To identify themes, responses were coded by assigning colors to each important topic as they emerged (ex: fuchsia = types of technology, purple = skills taught from utilized technology, etc.). Once

the interviews were coded and themes were identified, further examination yielded the need for themes to be combined into larger concepts with sub-themes providing more details. For the purpose of this study, six themes and two sub-themes answered the qualitative research question (see Table 3.4). The following themes were coded within the interview transcripts.

Table 3.4

Emergent Qualitative Interview Themes

Code Color	Theme	Examples
Fuchsia	Types of Technology	Smartboards, iPads, computers
Sub-Theme	Apps or Programs Used	Dreambox, IStation, Starfall, ABCya, Chatterpix, Nearpod
Sub-Theme	Reasons for Use	Part of rotations, assessments, longtime engagement, requirement, convenience
Yellow	Selection Strategies	Independence, developmentally appropriate, educational
Purple	Skills Taught from Utilized Technology	Research, alphabet knowledge, tracing letters, reading, mathematics
Orange	Professional Development/Training	Summer informational session, technology person, hands-on
Red	Beliefs about Technology Use	Mixed feelings, must use, use as little as possible
Navy Blue	Developmentally Appropriate Practices (DAP)	Research based, proven, appropriate

The interviews gave more depth and breadth to how teachers' perceptions contribute to considering developmentally appropriateness when choosing and using educational technology in early-childhood classrooms. They also examined what type of professional development was desired or utilized to help identify appropriate ways to use educational technology in early-childhood classrooms without sacrificing foundational skills, such as hands-on play.

Qualitative Validity

Various techniques were applied to increase the validity of this study. These techniques included triangulation, peer debriefing, and member checking. First, triangulation of ideas occurred through mentor editing throughout the process, and consultation of existing literature through similar studies and literature review. Feedback from colleagues permitted validation of data, analysis of information, and formulation of themes in this study. Second, peer debriefing occurred through mentoring from a university professor and from colleague feedback. All asked difficult questions and provided constructive criticism on the validity of data collection and analysis. This resulted in valuable feedback, which increased validity of data collection and analysis methods. Finally, member checking was used to accurately represent participants' subjectivity and decrease researcher bias. During interviews, semi-structured questions were incorporated, allowing the interviewer to ask additional questions, determining the accuracy of perceived understanding and/or clarifying validity. In addition, preliminary findings were shared with pilot interviewees to glean opinions on the interpretation of data.

Privacy and Ethical Considerations

Prior to the collection of any data, the researcher gained approval from UHCL's CPHS and the school district IRB in which the study took place. Given that the intended

survey instruments are published, the researcher had implied consent for their use. All participants were provided detailed information related to the purpose of the study, and directions for completing the surveys in the format of a cover letter embedded in the body of the survey. Interviewees signed a consent form at the beginning of the interview. In addition, the identity of all participants was protected using uni-sexed pseudonyms. The collected data remained secured on a pin drive in a locked cabinet in the researcher's classroom, and only the researcher had a key to the cabinet. The researcher will maintain the data for five years as required by the CPHS and school district IRB guidelines. After the expiration deadline, the researcher will destroy all data files associated with the study.

Research Design Limitations

The research design consists of several limitations. First, this study was conducted in one district in southeast Texas. The district and teacher demographics of the district may be hard to replicate, due to population, size, differences in possible teacher turnover rates, and years of teacher experience. As a result, the conclusions drawn from the research in this study may only be applicable to the participating district. Generalizations may prove questionable. Second, this study only focused on the implementation and use of educational technology in early-childhood classrooms. It does not consider the perceptions, attitudes, or appropriate practices of teachers in other grade levels. Participants' responses may be influenced by other grades they have taught, especially those not considered early-childhood. As a result, the findings of this study may be skewed.

Third, the level of honesty of the participants could vary. One must assume participants were completely honest when responding to the survey and interview questions. If the participants were dishonest in their responses, the validity of the findings could be jeopardized. Fourth, the district had 42 elementary school campuses. The

number of early-childhood teachers on each elementary school campus varied based on location and population size. For this study, only teachers in early-childhood grades (pre-K through 1st grade) were selected to participate.

In addition to the limitations listed above, it was difficult to find participants to complete both the survey and the interviews within the allotted time of the study. While there were numerous early-childhood teachers in the chosen district, time is always a factor and data were conducted after school hours, as per the district stipulations to research consent. Adhering to research parameters given by the district was an important factor to the study's success. Interviews were scheduled after school and at the convenience of the participants as much as possible. Communication was key for the success of the qualitative piece of research in this study.

Conclusion

The purpose of this study was to investigate the influence of early-childhood teachers' perceptions, attitudes, and technology proficiency on educational technology use in early-childhood classrooms, in order to provide needed support lending to successful implementation. This chapter identified the need to further examine the relationship amongst the constructs. It focused on the research problem, definitions of the constructs, the research purpose and questions, the research design, population and sampling of participants, the instrumentation, data collection procedures, data analysis, privacy and ethical considerations, and the limitations of the study. Chapter IV will provide a detailed description and demographic breakdown of the participants. In addition, survey and interview data will be analyzed and discussed in further detail.

CHAPTER IV:

RESULTS

The purpose of this study was to investigate the influence of early-childhood teachers' perceptions, attitudes, and technology proficiency on educational technology use in early-childhood classrooms. This chapter provides systematic results of the data analysis for both the quantitative and qualitative data collected for this study. The results of the data analysis for each of the study's four research questions are described below. Furthermore, the conclusion provides a collective summary of the qualitative and quantitative findings.

Participant Demographics

During the fall semester, all early-childhood teachers (pre-K through 1st grade) from 42 elementary schools in a large suburban school district in southeast Texas were sent an email soliciting their participation in the quantitative research of this study. The number of early-childhood teachers on each elementary school campus varied based on location and population size. The participating district employed 6,623 professional staff members. Of this staff, 5,274 are teachers (TEA, 2019), and 640 are early-childhood teachers as determined from the district directory. For the purpose of this study, only teachers in early-childhood grades (Pre-K – 1st grade) were selected to participate. A purposeful sample of 145 early-childhood teachers responded to the quantitative survey. Of those responses, 30 were deleted due to incomplete information, leaving 115 responses for analysis. Table 4.1 provides demographic data regarding age, years of service, gender, and highest level of education for the 115 participants (response rate = 79.3%) in the sample.

Most survey participants were females (97.3%, n = 112) between the ages of 31-40 years (30.4%, n = 36). Additionally, the highest degree held by most participants is a

bachelor's (68.7%, n = 79). Teachers' years of service was well distributed with 37 teachers (32.2%) having 0-5 years, 22 teachers (19.1%) having 6-10 years, 31 teachers (27.0%) having 11-20 years, and 25 teachers (21.7%) having 20 or more years.

Table 4.1

Demographics of Survey Participants

		Frequency (n)	Percentage (%)
1.	Teachers by Gender:		
	Male	3	2.6
	Female	112	97.3
2.	Teachers by Age:		
	21-30 years	29	25.2
	31-40 years	36	30.4
	41-50 years	27	23.5
	51-60 years	18	15.7
	60 + years	5	4.3
3.	Teachers by Years of Service:		
	0-5 years	37	32.2
	6-10 years	22	19.1
	11-20 years	31	27.0
	20 + years	25	21.7
4.	Teachers by Highest Degree Held:		
	Bachelor's	79	68.7
	Master's	36	31.3
	Doctorate	0	0.0

A purposeful sample size of 10 early-childhood teachers was solicited, via email, from the 115 early-childhood teachers, who completed the survey, to participate in the qualitative segment of the study. Qualitative research consisted of 15 semi-structured questions answered in interview format in a relaxed setting. Table 4.2 provides more demographic information about the 10 participants in the sample.

Table 4.2

Demographics of Interview Participants

Pseudo Name	Age Range	Level of Education	Gender	Years of Service
Bailey	31-40	Bachelor's	Male	15 years (5 EC)
Wanda	21-30	Bachelor's	Female	2 years (2 EC)
Astrid	41-50	Bachelor's	Female	21 years (10 EC)
Gwen	41-50	Master's	Female	18 years (8 EC)
Cameron	31-40	Bachelor's	Female	4 years (3 EC)
Fiona	21-30	Bachelor's	Female	1 year (1 EC)
Kennedy	21-30	Bachelor's	Female	1 year (1 EC)
Norah	41-50	Bachelor's	Female	22 years (22 EC)
Sawyer	21-30	Bachelor's	Female	2 years (2 EC)
Sutton	31-40	Bachelor's	Female	18 years (10 EC)

* EC = early-childhood

Qualitative participants demonstrated demographics from different age ranges and years of service. Wanda, Fiona, Kennedy, and Sawyer were the youngest participants, between 21-30 years old. Astrid, Gwen, and Norah were older participants, between 41-50 years old. Most of the participants were females (90.0%, n = 9), and most hold a bachelor's degree (90.0%, n = 9) as their highest level of education. Furthermore, the participants' years of service varied, with Wanda and Sawyer having the least (two years total, two years in early-childhood) and Norah having the most (22 years total, 22 years in early-childhood).

Research Question 1

Research question one, Does early-childhood teachers' years of service (a) 0–5 years of service, (b) 6 –10 years of service, (c) 11- 20 years of service, and (d) more than 20 years of service influence early-childhood teachers' technology proficiency?, was answered by conducting a one-way ANOVA to determine if there was a statistically significant mean difference in early-childhood teachers' technology proficiency among the four categories of years of service for early-childhood teachers. Results of the one-way ANOVA indicated early-childhood teachers' years of service does influence early-childhood teachers' technology proficiency, $F(3, 111) = 3.5$, $p = .019$, omega-squared (w^2) = .06, eta-squared (η^2) = .09. The proportion of variance explained in early-childhood teachers' technology proficiency by the early-childhood teachers' years of service ranged from 0.6% - 9.0%. The results of the Tukey Post Hoc indicated statistically significant mean differences between 11-20 years of service ($M = 122.77$) and 20+ years of service ($M = 112.32$) categories ($M_d = 10.45$). Table 4.3 displays the one-way ANOVA results

Table 4.3

One-Way ANOVA Results: Teachers' Technology Proficiency

Years of Service	N	M	SD	F-value	df	p-value	w^2	η^2
0-5 years	37	117.86	13.40	3.45	(3, 111)	.019*	.06	.09
6-10 years	22	115.27	13.11					
11-20 years	31	122.77	11.20					
20+ years	25	112.32	12.66					

* Statistically Significant ($p < .05$)

Research question one was also measured using frequencies, percentages of the *Technology Proficiency Self-Assessment for 21st Century Learning* (TPSA C21). The survey questionnaire relating years of service to technology proficiency included 34-items using a 4-point Likert scale (1 = *Strongly Disagree,* 2 = *Disagree,* 3 = *Agree,* 4 = *Strongly Agree*). The responses related to how years of service influenced technology proficiency are provided below.

0-5 Years of Service

All (100.0%) of early-childhood teachers with zero to five years of experience chose *Agree/Strongly Agree* when considering proficiency in sending emails and documents, finding primary sources of information on the Internet, creating a slideshow presentation, sending and receiving text messages, transferring data via smartphone, and saving/retrieving files in a cloud-based environment. In addition, *Agree/Strongly Agree* was chosen most of the time for all 34 questions in the survey. Participants were more conflicted choosing *Agree/Strongly Agree* when considering creating a webpage (63.6%), creating a wiki or blog (64.5%), and using mobile devices to connect to others for professional development (77.4%). Early-childhood teachers with zero to five years of experience self-reported having an overall proficiency in technology use, with the highest

uncertainty (*Disagree/Strongly Disagree*) in creating a webpage (35.1%) and creating a wiki or blog (59.5%).

6–10 Years of Service

All (100.0%) of early-childhood teachers with six to 10 years of experience chose *Agree/Strongly Agree* when considering proficiency in sending emails and documents, keeping copies of outgoing emails, finding primary sources of information on the Internet, bookmarking previously visited Web sites, saving documents in multiple formats, creating a slideshow presentation, downloading and reading e-books, downloading and streaming movies/videos, sending and receiving text messages, and transferring data via smartphone. Choices for question 20: *…write a plan with a budget to buy technology for my classroom,* were conflicted. Half (50.0%) of participants choose *Disagree/Strongly Disagree* and half (50.0%) chose *Agree/Strongly Agree.* In addition, *Agree/Strongly Agree* was chosen most of the time for 32 out of 34 questions in the survey. Early-childhood teachers with six to 10 years of experience chose mostly *Disagree/Strongly Disagree* when considering creating a wiki or blog (63.6%) and using online tools for distance learning (63.6%).

11–20 Years of Service

All (100.0%) of early-childhood teachers with 11 to 20 years of experience chose *Agree/Strongly Agree* when considering proficiency in sending emails and documents, keeping copies of outgoing emails, finding primary sources of information on the Internet, searching for specific Web sites, bookmarking previously visited Web sites, finding Internet sources to use in teaching, creating a slideshow presentation, using technology to collaborate with others, integrating mobile technologies into curriculum, downloading and streaming movies/videos, sending and receiving text messages, transferring data via smartphone, and saving/receiving files in a cloud-based

environment. In addition, *Agree/Strongly Agree* was chosen most of the time for all 34 questions in the survey. Participants were more conflicted choosing *Agree/Strongly Agree* when considering creating a webpage (64.9%), writing a budget plan to buy classroom technology (73.0%), using social media tools for instruction (75.7%), creating a wiki or blog (59.5%), using online tools for distance learning (75.7%), and using mobile devices to connect to others for professional development (78.4%). Early-childhood teachers with 11 to 20 years of experience self-reported having an overall proficiency in technology use, with the highest uncertainty (*Disagree/Strongly Disagree*) in creating a wiki or blog (35.5%).

20+ Years of Service

All (100.0%) of early-childhood teachers with more than 20 years of experience chose *Agree/Strongly Agree* when considering proficiency in sending emails and documents, keeping copies of outgoing emails, finding primary sources of information on the Internet, searching for specific Web sites, bookmarking previously visited Web sites, and finding Internet sources to use in teaching. In addition, *Agree/Strongly Agree* was chosen most of the time for 31 out of 34 questions in the survey. Early-childhood teachers with more than 20 years of experience chose mostly *Disagree/Strongly Disagree* when considering creating a web page (68.0%), creating a wiki or blog (64.0%), and using mobile devices to connect with others for professional development (56.0%).

Total Years of Service Comparison

Early-childhood teachers in all years of service categories reported having overall technology proficiency. All (100.0%) participants chose *Agree/Strongly Agree* when considering proficiency in sending emails and sending document attachments. A lack of proficiency was reported when considering creating a web page for early-childhood teachers with more than 20 years of experience (68.0%); creating a wiki or blog for early-

childhood teachers with six to 10 years of experience (63.6%) and more than 20 years of experience (64.0); and using mobile devices to connect to others for professional development for early-childhood teachers with more than 20 years of experience (56.0%). Tables 4.4 and 4.5 display the percentages and frequencies of participants with zero to 20+ years of service in expanded form and collapsed form respectively on self-assessment of technology proficiency.

Table 4.4

Expanded Responses to Teachers' Technology Proficiency for All Participants (%)

Survey Item		Strongly Disagree	Disagree	Agree	Strongly Agree
I feel confident that I could…					
1. ...send e-mail to a friend.	0-5 years	0.0 (n = 0)	0.0 (n = 0)	2.7 (n = 1)	97.3 (n = 36)
	6-10 years	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	100.0 (n = 22)
	11-20 years	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	100.0 (n = 31)
	20+ years	0.0 (n = 0)	0.0 (n = 0)	0.0 (n = 0)	100.0 (n = 25)
	All	0.0 (n = 0)	0.0 (n = 0)	0.1 (n = 1)	99.1 (n = 114)
2. ...subscribe to a discussion list.	0-5 years	5.4 (n = 2)	10.8 (n = 4)	24.3 (n = 9)	59.5 (n = 22)
	6-10 years	0.0 (n = 0)	9.0 (n = 2)	36.4 (n = 8)	54.5 (n = 12)
	11-20 years	0.0 (n = 0)	3.2 (n = 1)	19.4 (n = 6)	77.4 (n = 24)

	20+ years	0.0	4.0	28.0	68.0
		(n = 0)	(n = 1)	(n = 7)	(n = 17)
	All	1.7	7.0	26.1	65.2
		(n = 2)	(n = 8)	(n = 30)	(n = 75)
	0-5 years	0.0	10.8	13.5	75.7
3. ...create a distribution		(n = 0)	(n = 4)	(n = 5)	(n = 28)
list" to send e-mail	6-10 years	0.0	4.5	27.3	68.2
to several people at		(n = 0)	(n = 1)	(n = 6)	(n = 15)
once.	11-20 years	0.0	3.2	9.7	87.1
		(n = 0)	(n = 1)	(n = 3)	(n = 27)
	20+ years	0.0	8.0	16.0	76.0
		(n = 0)	(n = 2)	(n = 4)	(n = 19)
	All	0.0	7.0	15.7	77.4
		(n = 0)	(n = 8)	(n = 18)	(n = 89)
	0-5 years	0.0	0.0	5.4	94.6
4. ...send a document as		(n = 0)	(n = 0)	(n = 2)	(n = 35)
an attachment to an	6-10 years	0.0	0.0	0.0	100.0
e-mail message.		(n = 0)	(n = 0)	(n = 0)	(n = 22)
	11-20 years	0.0	0.0	0.0	100.0
		(n = 0)	(n = 0)	(n = 0)	(n = 31)
	20+ years	0.0	0.0	0.0	100.0
		(n = 0)	(n = 0)	(n = 0)	(n = 25)
	All	0.0	0.0	1.7	98.3
		(n = 0)	(n = 0)	(n = 2)	(n = 113)
	0-5 years	2.7	5.4	19.0	73.0
5. ...keep copies of		(n = 1)	(n = 2)	(n = 7)	(n = 27)
outgoing messages	6-10 years	0.0	0.0	18.2	81.8
that I send to others.		(n = 0)	(n = 0)	(n = 4)	(n = 18)

	11-20 years	0.0 (n = 0)	0.0 (n = 0)	9.7 (n = 3)	90.3 (n = 28)
	20+ years	0.0 (n = 0)	0.0 (n = 0)	12.0 (n = 3)	88.0 (n = 22)
	All	0.0 (n = 1)	47.2 (n = 2)	30.1 (n = 17)	9.0 (n = 95)
	0-5 years	2.7 (n = 1)	5.4 (n = 2)	18.9 (n = 7)	73.0 (n = 27)
6. ...use an Internet search engine (e.g., Google) to find Web pages related to subject matter interests.	6-10 years	0.0 (n = 0)	0.0 (n = 0)	18.2 (n = 4)	81.8 (n = 18)
	11-20 years	0.0 (n = 0)	0.0 (n = 0)	9.7 (n = 3)	90.3 (n = 28)
	20+ years	0.0 (n = 0)	0.0 (n = 0)	12.0 (n = 3)	88.0 (n = 22)
	All	0.9 (n = 1)	1.7 (n = 2)	14.8 (n = 17)	82.6 (n = 95)
	0-5 years	2.7 (n = 1)	2.7 (n = 1)	18.9 (n = 7)	6.0 (n = 28)
7. ...search for and find the Smithsonian Institution Website.	6-10 years	0.0 (n = 0)	9.0 (n = 2)	13.6 (n = 3)	77.3 (n = 17)
	11-20 years	0.0 (n = 0)	0.0 (n = 0)	6.5 (n = 2)	93.5 (n = 29)
	20+ years	0.0 (n = 0)	0.0 (n = 0)	4.0 (n = 1)	96.0 (n = 24)
	All	0.9 (n = 1)	2.6 (n = 3)	11.3 (n = 13)	85.2 (n = 98)

	0-5 years	16.2 (n = 6)	18.9 (n = 7)	37.8 (n = 14)	27.0 (n = 10)
8. ...create my own web page.	6-10 years	4.5 (n = 1)	31.8 (n = 7)	50.0 (n = 11)	13.6 (n = 3)
	11-20 years	9.7 (n = 3)	22.6 (n = 7)	35.5 (n = 11)	32.3 (n = 10)
	20+ years	12.0 (n = 3)	56.0 (n = 14)	28.0 (n = 7)	4.0 (n = 1)
	All	11.3 (n = 13)	30.4 (n = 35)	37.4 (n = 43)	20.9 (n = 24)
	0-5 years	0.0 (n = 0)	2.7 (n = 1)	13.5 (n = 5)	83.8 (n = 31)
9. ...keep track of Web sites I have visited so that I can return to them later. (An example is using bookmarks.)	6-10 years	0.0 (n = 0)	0.0 (n = 0)	9.1 (n = 2)	90.9 (n = 20)
	11-20 years	0.0 (n = 0)	0.0 (n = 0)	16.1 (n = 5)	83.9 (n = 26)
	20+ years	0.0 (n = 0)	0.0 (n = 0)	24.0 (n = 6)	76.0 (n = 19)
	All	0.0 (n = 0)	0.9 (n = 1)	15.7 (n = 18)	83.5 (n = 96)
	0-5 years	0.0 (n = 0)	0.0 (n = 0)	21.6 (n = 8)	78.4 (n = 29)
10. ...find primary sources of information on the Internet that I can use in my teaching.	6-10 years	0.0 (n = 0)	4.5 (n = 1)	36.4 (n = 8)	59.1 (n = 13)
	11-20 years	0.0 (n = 0)	0.0 (n = 0)	16.1 (n = 5)	83.9 (n = 26)
	20+ years	0.0 (n = 0)	0.0 (n = 0)	8.0 (n = 2)	92.0 (n = 23)

	All	0.0 (n = 0)	0.9 (n = 1)	20.0 (n = 23)	79.1 (n = 91)
	0-5 years	2.7 (n = 1)	13.5 (n = 5)	40.5 (n = 15)	43.2 (n = 16)
11. ...use a spreadsheet to create a bar graph of the proportions of the different colors of M&Ms in a bag.	6-10 years	0.0 (n = 0)	18.2 (n = 4)	31.8 (n = 7)	50.0 (n = 11)
	11-20 years	3.2 (n = 1)	6.5 (n = 2)	19.4 (n = 6)	71.0 (n = 22)
	20+ years	0.0 (n = 0)	12.0 (n = 3)	64.0 (n = 16)	24.0 (n = 6)
	All	1.7 (n = 2)	12.2 (n = 14)	38.3 (n = 44)	47.8 (n = 55)
	0-5 years	2.7 (n = 1)	8.1 (n = 3)	40.5 (n = 15)	48.6 (n = 18)
12. ...create a newsletter with graphics.	6-10 years	0.0 (n = 0)	18.2 (n = 4)	27.3 (n = 6)	54.5 (n = 12)
	11-20 years	0.0 (n = 0)	3.2 (n = 1)	16.1 (n = 5)	80.6 (n = 25)
	20+ years	4.0 (n = 1)	4.0 (n = 1)	48.0 (n = 12)	44.0 (n = 11)
	All	1.7 (n = 2)	7.8 (n = 9)	33.0 (n = 38)	57.4 (n = 66)
	0-5 years	0.0 (n = 0)	2.7 (n = 1)	37.0 (n = 10)	70.3 (n = 26)
13. ...save documents in formats so that others can read them	6-10 years	0.0 (n = 0)	0.0 (n = 0)	27.3 (n = 6)	72.7 (n = 16)

if they have different word processing programs (eg., saving Word, pdf, RTF, or text).	11-20 years	0.0 (n = 0)	3.2 (n = 1)	16.1 (n = 5)	80.6 (n = 25)
	20+ years	0.0 (n = 0)	16.0 (n = 4)	20.0 (n = 7)	56.0 (n = 14)
	All	0.0 (n = 0)	5.2 (n = 6)	24.3 (n = 28)	70.4 (n = 81)
14. …use the computer to create a slideshow presentation.	0-5 years	0.0 (n = 0)	0.0 (n = 0)	18.9 (n = 7)	81.1 (n = 30)
	6-10 years	0.0 (n = 0)	0.0 (n = 0)	9.1 (n = 2)	90.9 (n = 20)
	11-20 years	0.0 (n = 0)	0.0 (n = 0)	6.5 (n = 2)	93.5 (n = 29)
	20+ years	0.0 (n = 0)	4.0 (n = 1)	28.0 (n = 7)	68.0 (n = 17)
	All	0.0 (n = 0)	0.9 (n = 1)	15.7 (n = 18)	83.5 (n = 96)
15. ...create a database of information about important authors in a subject matter field.	0-5 years	5.4 (n = 2)	18.9 (n = 7)	45.9 (n = 17)	29.7 (n = 11)
	6-10 years	9.1 (n = 2)	27.3 (n = 6)	31.8 (n = 7)	31.8 (n = 7)
	11-20 years	3.2 (n = 1)	9.7 (n = 3)	32.3 (n = 10)	54.8 (n = 17)
	20+ years	8.0 (n = 2)	28.0 (n = 7)	52.0 (n = 13)	12.0 (n = 3)
	All	6.1 (n = 7)	20.0 (n = 23)	40.9 (n = 47)	33.0 (n = 38)

	0-5 years	0.0	5.4	40.5	54.1
16. …write an essay		(n = 0)	(n = 2)	(n = 15)	(n = 20)
describing how I	6-10 years	0.0	4.5	50.0	45.5
would use		(n = 0)	(n = 1)	(n = 11)	(n = 10)
technology in my	11-20 years	0.0	3.2	22.6	74.2
classroom.		(n = 0)	(n = 1)	(n = 7)	(n = 23)
	20+ years	4.0	0.0	36.0	60.0
		(n = 1)	(n = 0)	(n = 9)	(n = 15)
	All	0.9	3.5	36.5	59.1
		(n = 1)	(n = 4)	(n = 42)	(n = 68)
	0-5 years	0.0	18.9	48.6	32.4
17. ...create a lesson or		(n = 0)	(n = 7)	(n = 18)	(n = 12)
unit that	6-10 years	9.1	13.6	40.9	36.4
incorporates subject		(n = 2)	(n = 3)	(n = 9)	(n = 8)
matter software as	11-20 years	0.0	16.1	32.3	51.6
an integral part.		(n = 0)	(n = 5)	(n = 10)	(n = 16)
	20+ years	4.0	12.0	60.0	24.0
		(n = 1)	(n = 3)	(n = 15)	(n = 6)
	All	2.6	15.7	45.2	36.5
		(n = 3)	(n = 18)	(n = 52)	(n = 42)
	0-5 years	2.7	5.4	40.5	51.4
18. ...use technology to		(n = 1)	(n = 2)	(n = 15)	(n = 19)
collaborate with	6-10 years	0.0	22.7	27.3	50.0
teachers or students,		(n = 0)	(n = 5)	(n = 6)	(n = 11)
who are distant from	11-20 years	0.0	0.0	38.7	61.3
my classroom.		(n = 0)	(n = 0)	(n = 12)	(n = 19)
	20+ years	4.0	12.0	40.0	44.0
		(n = 1)	(n = 3)	(n = 10)	(n = 11)

	All	1.7 (n = 2)	8.7 (n = 10)	37.4 (n = 43)	52.2 (n = 60)
	0-5 years	0.0 (n = 0)	8.1 (n = 3)	40.5 (n = 15)	51.4 (n = 19)
19. … describe 5 software programs or apps that I would use in my teaching.	6-10 years	0.0 (n = 0)	22.7 (n = 5)	18.2 (n = 4)	59.1 (n = 13)
	11-20 years	0.0 (n = 0)	3.2 (n = 1)	48.4 (n = 15)	48.4 (n = 15)
	20+ years	4.0 (n = 1)	12.0 (n = 3)	48.0 (n = 12)	36.0 (n = 9)
	All	0.9 (n = 1)	10.4 (n = 12)	40.0 (n = 46)	48.7 (n = 56)
	0-5 years	8.1 (n = 3)	18.9 (n = 7)	59.5 (n = 22)	13.5 (n = 5)
20. ...write a plan with a budget to buy technology for my classroom.	6-10 years	0.0 (n = 0)	50.0 (n = 11)	31.8 (n = 7)	18.2 (n = 4)
	11-20 years	0.0 (n = 0)	19.4 (n = 6)	48.4 (n = 15)	32.3 (n = 10)
	20+ years	4.0 (n = 1)	24.0 (n = 6)	64.0 (n = 16)	8.0 (n = 2)
	All	3.5 (n = 4)	26.1 (n = 30)	52.2 (n = 60)	18.3 (n = 21)
	0-5 years	0.0 (n = 0)	2.7 (n = 1)	48.6 (n = 18)	48.6 (n = 18)
21. …integrate mobile technologies (ex. tablets, phones, etc.) into my curriculum.	6-10 years	0.0 (n = 0)	13.6 (n = 3)	22.7 (n = 5)	63.6 (n = 14)
	11-20 years	0.0 (n = 0)	0.0 (n = 0)	25.8 (n = 8)	74.2 (n = 23)

	20+ years	12.0 (n = 3)	0.0 (n = 0)	48.0 (n = 12)	40.0 (n = 10)
	All	2.6 (n = 3)	3.5 (n = 4)	37.4 (n = 43)	56.5 (n = 65)
	0-5 years	2.7 (n = 1)	21.6 (n = 8)	32.4 (n = 12)	43.2 (n = 16)
22. …use social media tools for instruction in the classroom. (ex. Facebook, Twitter, etc.)	6-10 years	0.0 (n = 0)	36.4 (n = 8)	27.3 (n = 6)	36.4 (n = 8)
	11-20 years	6.5 (n = 2)	12.9 (n = 4)	32.3 (n = 10)	48.4 (n = 15)
	20+ years	4.0 (n = 1)	32.0 (n = 8)	32.0 (n = 8)	32.0 (n = 8)
	All	3.5 (n = 4)	24.3 (n = 28)	31.3 (n = 36)	40.9 (n = 47)
	0-5 years	13.5 (n = 5)	27.0 (n = 10)	40.5 (n = 15)	18.9 (n = 7)
23. …create a wiki or blog to have my students collaborate.	6-10 years	4.5 (n = 1)	59.1 (n = 13)	18.2 (n = 4)	18.2 (n = 4)
	11-20 years	3.2 (n = 1)	32.3 (n = 10)	45.2 (n = 14)	19.4 (n = 6)
	20+ years	16.0 (n = 4)	48.0 (n = 12)	28.0 (n = 7)	8.0 (n = 2)
	All	9.6 (n = 11)	39.1 (n = 45)	34.8 (n = 40)	16.5 (n = 19)
	0-5 years	5.4 (n = 2)	18.9 (n = 7)	40.5 (n = 15)	35.1 (n = 13)
24. …use online tools to teach my students from a distance.	6-10 years	4.5 (n = 1)	59.1 (n = 13)	22.7 (n = 5)	13.6 (n = 3)

	11-20 years	0.0 (n = 0)	19.4 (n = 6)	38.7 (n = 12)	41.9 (n = 13)
	20+ years	8.0 (n = 2)	36.0 (n = 9)	40.0 (n = 10)	16.0 (n = 4)
	All	4.3 (n = 5)	30.4 (n = 35)	36.5 (n = 42)	28.7 (n = 33)
	0-5 years	0.0 (n = 0)	10.8 (n = 4)	48.6 (n = 18)	40.5 (n = 15)
25. …teach in a one-to-one environment in which the students have their own device.	6-10 years	4.5 (n = 1)	31.8 (n = 7)	22.7 (n = 5)	40.9 (n = 9)
	11-20 years	0.0 (n = 0)	12.9 (n = 4)	32.3 (n = 10)	54.8 (n = 17)
	20+ years	8.0 (n = 2)	12.0 (n = 3)	56.0 (n = 14)	24.0 (n = 6)
	All	2.6 (n = 3)	15.7 (n = 18)	40.9 (n = 47)	40.9 (n = 47)
	0-5 years	0.0 (n = 0)	18.9 (n = 7)	37.8 (n = 14)	43.4 (n = 16)
26. …find a way to use a smartphone in my classroom for student responses.	6-10 years	4.5 (n = 1)	22.7 (n = 5)	40.9 (n = 9)	31.8 (n = 7)
	11-20 years	0.0 (n = 0)	12.9 (n = 4)	38.7 (n = 12)	48.4 (n = 15)
	20+ years	12.0 (n = 3)	40.0 (n = 10)	36.0 (n = 9)	12.0 (n = 3)
	All	3.5 (n = 4)	22.6 (n = 26)	38.3 (n = 44)	35.7 (n = 41)

	0-5 years	0.0 (n = 0)	21.6 (n = 8)	40.5 (n = 15)	37.8 (n = 14)
27. … use mobile devices to connect to others for my professional development.	6-10 years	9.1 (n = 2)	31.8 (n = 7)	36.4 (n = 8)	22.7 (n = 5)
	11-20 years	6.5 (n = 2)	16.1 (n = 5)	50.0 (n = 11)	41.9 (n = 13)
	20+ years	28.0 (n = 7)	28.0 (n = 7)	32.0 (n = 8)	12.0 (n = 3)
	All	9.6 (n = 11)	23.5 (n = 27)	36.5 (n = 42)	30.4 (n = 35)
	0-5 years	0.0 (n = 0)	5.4 (n = 2)	48.6 (n = 18)	45.9 (n = 17)
28. … use mobile devices to have my students access learning activities.	6-10 years	0.0 (n = 0)	36.4 (n = 8)	18.2 (n = 4)	45.5 (n = 10)
	11-20 years	0.0 (n = 0)	9.7 (n = 3)	45.2 (n = 14)	45.2 (n = 14)
	20+ years	8.0 (n = 2)	16.0 (n = 4)	44.0 (n = 11)	32.0 (n = 8)
	All	1.7 (n = 2)	14.8 (n = 17)	40.9 (n = 47)	42.6 (n = 49)
	0-5 years	0.0 (n = 0)	2.7 (n = 1)	32.4 (n = 12)	64.9 (n = 24)
29. … download and listen to podcasts/audio books.	6-10 years	0.0 (n = 0)	13.6 (n = 3)	27.3 (n = 6)	59.1 (n = 13)
	11-20 years	0.0 (n = 0)	3.2 (n = 1)	19.4 (n = 6)	77.4 (n = 24)
	20+ years	0.0 (n = 0)	4.0 (n = 1)	48.0 (n = 12)	48.0 (n = 12)

	All	0.0 (n = 0)	5.2 (n = 6)	31.3 (n = 36)	63.5 (n = 73)
	0-5 years	0.0 (n = 0)	5.4 (n = 2)	24.3 (n = 9)	70.3 (n = 26)
30. … download and read e-books.	6-10 years	0.0 (n = 0)	0.0 (n = 0)	36.4 (n = 8)	63.6 (n = 14)
	11-20 years	0.0 (n = 0)	3.2 (n = 1)	19.4 (n = 6)	77.4 (n = 24)
	20+ years	0.0 (n = 0)	8.0 (n = 2)	32.0 (n = 8)	60.0 (n = 15)
	All	0.0 (n = 0)	4.3 (n = 5)	27.0 (n = 31)	68.7 (n = 79)
	0-5 years	0.0 (n = 0)	2.7 (n = 1)	18.9 (n = 7)	78.4 (n = 29)
31. … download and view streaming movies/video clips.	6-10 years	0.0 (n = 0)	0.0 (n = 0)	22.7 (n = 5)	77.3 (n = 17)
	11-20 years	0.0 (n = 0)	0.0 (n = 0)	12.9 (n = 4)	87.1 (n = 27)
	20+ years	0.0 (n = 0)	0.0 (n = 0)	36.0 (n = 9)	64.0 (n = 16)
	All	0.0 (n = 0)	8.7 (n = 1)	21.7 (n = 25)	77.4 (n = 89)
	0-5 years	0.0 (n = 0)	0.0 (n = 0)	13.5 (n = 5)	86.5 (n = 32)
32. … send and receive text messages.	6-10 years	0.0 (n = 0)	0.0 (n = 0)	4.5 (n = 1)	95.5 (n = 21)
	11-20 years	0.0 (n = 0)	0.0 (n = 0)	6.5 (n = 2)	93.5 (n = 29)

	20+ years	0.0 (n = 0)	0.0 (n = 0)	4.0 (n = 1)	96.0 (n = 24)
	All	0.0 (n = 0)	0.0 (n = 0)	7.8 (n = 9)	92.2 (n = 106)
	0-5 years	0.0 (n = 0)	0.0 (n = 0)	13.5 (n = 5)	86.5 (n = 32)
33. … transfer photos or other data via a smartphone.	6-10 years	0.0 (n = 0)	0.0 (n = 0)	13.6 (n = 3)	86.4 (n = 19)
	11-20 years	0.0 (n = 0)	0.0 (n = 0)	12.9 (n = 4)	87.1 (n = 27)
	20+ years	0.0 (n = 0)	4.0 (n = 1)	20.0 (n = 5)	76.0 (n = 19)
	All	0.0 (n = 0)	0.9 (n = 1)	14.8 (n = 17)	84.3 (n = 97)
	0-5 years	0.0 (n = 0)	0.0 (n = 0)	21.6 (n = 8)	78.4 (n = 29)
34. … save and retrieve files in a cloud-based environment.	6-10 years	0.0 (n = 0)	4.5 (n = 1)	27.3 (n = 6)	68.2 (n = 15)
	11-20 years	0.0 (n = 0)	0.0 (n = 0)	32.3 (n = 10)	67.7 (n = 21)
	20+ years	0.0 (n = 0)	4.0 (n = 1)	48.0 (n = 12)	48.0 (n = 12)
	All	0.0 (n = 0)	1.7 (n = 2)	31.3 (n = 36)	67.0 (n = 77)

Table 4.5

Collapsed Responses to Teachers' Technology Proficiency for All Participants (%)

Survey Item		Strongly Disagree/Disagree	Agree/Strongly Agree
I feel confident that I could…			
1. ...send e-mail to a friend.	0-5 years	0.0 (n = 0)	100.0 (n = 37)
	6-10 years	0.0 (n = 0)	100.0 (n = 22)
	11-20 years	0.0 (n = 0)	100.0 (n = 31)
	20+ years	0.0 (n = 0)	100.0 (n = 25)
	All	0.0 (n = 0)	100.0 (n = 115)
2. ...subscribe to a discussion list.	0-5 years	16.2 (n = 6)	83.8 (n = 31)
	6-10 years	9.1 (n = 2)	90.9 (n = 20)
	11-20 years	3.2 (n = 1)	96.8 (n = 30)
	20+ years	4.0 (n = 1)	96.0 (n = 24)
	All	8.7 (n = 10)	91.3 (n = 105)

	0-5 years	10.8 (n = 4)	89.2 (n = 33)
3. ...create a distribution list" to send e-mail to several people at once.	6-10 years	4.5 (n = 1)	95.5 (n = 21)
	11-20 years	3.2 (n = 1)	96.8 (n = 30)
	20+ years	8.0 (n = 2)	92.0 (n = 23)
	All	7.0 (n = 8)	93.0 (n = 107)
	0-5 years	0.0 (n = 0)	100.0 (n = 37)
4. ...send a document as an attachment to an e-mail message.	6-10 years	0.0 (n = 0)	100.0 (n = 22)
	11-20 years	0.0 (n = 0)	100.0 (n = 31)
	20+ years	0.0 (n = 0)	100.0 (n = 25)
	All	0.0 (n = 0)	100.0 (n = 115)
	0-5 years	8.1 (n = 3)	91.9 (n = 34)
5. ...keep copies of outgoing messages that I send to others.	6-10 years	0.0 (n = 0)	100.0 (n = 22)
	11-20 years	0.0 (n = 0)	100.0 (n = 31)
	20+ years	0.0 (n = 0)	100.0 (n = 25)

	All	2.6 (n = 3)	97.4 (n = 112)
	0-5 years	8.1 (n = 3)	91.9 (n = 34)
6. ...use an Internet search engine (e.g., Google) to find Web pages related to subject matter interests.	6-10 years	0.0 (n = 0)	100.0 (n = 22)
	11-20 years	0.0 (n = 0)	100.0 (n = 31)
	20+ years	0.0 (n = 0)	100.0 (n = 25)
	All	2.6 (n = 3)	97.4 (n = 112)
	0-5 years	5.4 (n = 2)	94.6 (n = 35)
7. ...search for and find the Smithsonian Institution Website.	6-10 years	9.1 (n = 2)	90.9 (n = 20)
	11-20 years	0.0 (n = 0)	100.0 (n = 31)
	20+ years	0.0 (n = 0)	100.0 (n = 25)
	All	3.5 (n = 4)	96.5 (n = 111)
	0-5 years	35.1 (n = 13)	64.9 (n = 24)
8. ...create my own web page.	6-10 years	36.4 (n = 8)	63.6 (n = 14)
	11-20 years	32.3 (n = 10)	63.6 (n = 21)

	20+ years	68.0	32.0
		(n = 17)	(n = 8)
	All	41.7	58.3
		(n = 48)	(n = 67)
	0-5 years	2.7	97.3
9. ...keep track of Web		(n = 1)	(n = 36)
sites I have visited so	6-10 years	0.0	100.0
that I can return to		(n = 0)	(n = 22)
them later. (An	11-20 years	0.0	100.0
example is using		(n = 0)	(n = 31)
bookmarks.)	20+ years	0.0	100.0
		(n = 0)	(n = 25)
	All	0.9	99.1
		(n = 1)	(n = 114)
	0-5 years	0.0	100.0
10. ...find primary		(n = 0)	(n = 37)
sources of	6-10 years	4.5	95.5
information on the		(n = 1)	(n = 21)
Internet that I can	11-20 years	0.0	100.0
use in my teaching.		(n = 0)	(n = 31)
	20+ years	0.0	100.0
		(n = 0)	(n = 25)
	All	0.9	99.1
		(n = 1)	(n = 114)
	0-5 years	16.2	83.8
11. ...use a spreadsheet		(n = 6)	(n = 31)
to create a bar graph	6-10 years	18.2	81.8
of the proportions		(n = 4)	(n = 18)

of the different colors of M&Ms in a bag.	11-20 years	9.7 (n = 3)	90.3 (n = 28)
	20+ years	12.0 (n = 3)	88.0 (n = 22)
	All	13.9 (n = 16)	86.1 (n = 99)
12. ...create a newsletter with graphics.	0-5 years	10.8 (n = 4)	89.2 (n = 33)
	6-10 years	18.2 (n = 4)	81.8 (n = 18)
	11-20 years	3.2 (n = 1)	96.8 (n = 30)
	20+ years	8.0 (n = 2)	92.0 (n = 23)
	All	9.6 (n = 11)	90.4 (n = 104)
13. ...save documents in formats so that others can read them if they have different word processing programs (eg., saving Word, pdf, RTF, or text).	0-5 years	2.7 (n = 1)	97.3 (n =36)
	6-10 years	0.0 (n = 0)	100.0 (n = 22)
	11-20 years	3.2 (n = 1)	96.8 (n = 30)
	20+ years	16.0 (n = 4)	84.0 (n = 21)
	All	5.2 (n = 6)	94.8 (n = 109)

	0-5 years	0.0	100.0
14. …use the computer		(n = 0)	(n = 37)
to create a	6-10 years	0.0	100.0
slideshow		(n = 0)	(n = 22)
presentation.	11-20 years	0.0	100.0
		(n = 0)	(n = 31)
	20+ years	4.0	96.0
		(n = 1)	(n = 24)
	All	0.9	99.1
		(n = 1)	(n = 114)
	0-5 years	24.3	75.7
15. ...create a database		(n = 9)	(n = 28)
of information	6-10 years	36.4	63.6
about important		(n = 8)	(n = 14)
authors in a subject	11-20 years	12.9	87.1
matter field.		(n = 4)	(n = 27)
	20+ years	36.0	64.0
		(n = 9)	(n = 16)
		26.1	73.9
	All	(n = 30)	(n = 85)
	0-5 years	5.4	94.6
16. …write an essay		(n = 2)	(n = 35)
describing how I	6-10 years	4.5	95.5
would use		(n = 1)	(n = 21)
technology in my	11-20 years	3.2	96.8
classroom.		(n = 1)	(n = 30)
	20+ years	4.0	96.0
		(n = 1)	(n = 24)

	All	4.3 (n = 5)	95.7 (n = 110)
	0-5 years	18.9 (n = 7)	81.1 (n = 30)
17. ...create a lesson or unit that incorporates subject matter software as an integral part.	6-10 years	22.7 (n = 5)	77.3 (n = 17)
	11-20 years	16.1 (n = 5)	83.9 (n = 26)
	20+ years	16.0 (n = 4)	84.0 (n = 21)
	All	18.3 (n = 21)	81.7 (n = 94)
	0-5 years	8.1 (n = 3)	91.9 (n = 34)
18. ...use technology to collaborate with teachers or students, who are distant from my classroom.	6-10 years	22.7 (n = 5)	77.3 (n = 17)
	11-20 years	0.0 (n = 0)	100.0 (n = 31)
	20+ years	16.0 (n = 4)	84.0 (n = 21)
	All	10.4 (n = 12)	89.6 (n = 103)
	0-5 years	0.8 (n = 3)	91.9 (n = 34)
19. … describe 5 software programs or apps that I would use in my teaching.	6-10 years	22.7 (n = 5)	77.3 (n = 17)
	11-20 years	3.2 (n = 1)	96.8 (n = 30)

	20+ years	16.0 (n = 4)	84.0 (n = 21)
	All	11.3 (n = 13)	88.7 (n = 102)
	0-5 years	27.0 (n = 10)	73.0 (n = 27)
20. ...write a plan with a budget to buy technology for my classroom.	6-10 years	50.0 (n = 11)	50.0 (n = 11)
	11-20 years	19.4 (n = 6)	80.6 (n = 25)
	20+ years	28.0 (n = 7)	72.0 (n = 18)
	All	29.6 (n = 34)	70.4 (n = 81)
	0-5 years	2.7 (n = 1)	97.3 (n = 36)
21. …integrate mobile technologies (ex. tablets, phones, etc.) into my curriculum.	6-10 years	13.6 (n = 3)	86.4 (n = 19)
	11-20 years	0.0 (n = 0)	100.0 (n = 31)
	20+ years	12.0 (n = 3)	88.0 (n = 22)
	All	6.1 (n = 7)	93.9 (n = 108)
	0-5 years	24.3 (n = 9)	75.7 (n = 28)
22. …use social media tools for instruction in the	6-10 years	36.4 (n = 8)	63.6 (n = 14)

classroom. (ex. Facebook, Twitter, etc.)	11-20 years	19.4 (n = 6)	80.6 (n = 25)
	20+ years	36.0 (n = 9)	64.0 (n = 16)
	All	27.8 (n = 32)	72.2 (n = 83)
	0-5 years	40.5 (n = 15)	59.5 (n = 22)
23. …create a wiki or blog to have my students collaborate.	6-10 years	63.6 (n = 14)	36.4 (n = 8)
	11-20 years	35.5 (n = 11)	64.5 (n = 20)
	20+ years	64.0 (n = 16)	36.0 (n = 9)
	All	48.7 (n = 56)	51.3 (n = 59)
	0-5 years	24.3 (n = 9)	75.7 (n = 28)
24. …use online tools to teach my students from a distance.	6-10 years	63.6 (n = 14)	36.4 (n = 8)
	11-20 years	19.4 (n = 6)	80.6 (n = 25)
	20+ years	44.0 (n = 11)	56.0 (n = 14)
	All	34.8 (n = 40)	65.2 (n = 75)

	0-5 years	10.8 (n = 4)	89.2 (n = 33)
25. …teach in a one-to-one environment in which the students have their own device.	6-10 years	36.4 (n = 8)	63.6 (n = 14)
	11-20 years	12.9 (n = 4)	87.1 (n = 27)
	20+ years	20.0 (n = 5)	80.0 (n = 20)
	All	18.3 (n = 21)	81.7 (n = 94)
	0-5 years	18.9 (n = 7)	81.1 (n = 30)
26. …find a way to use a smartphone in my classroom for student responses.	6-10 years	27.3 (n = 6)	72.7 (n = 16)
	11-20 years	12.9 (n = 4)	87.1 (n = 27)
	20+ years	52.0 (n = 13)	48.0 (n = 12)
	All	26.1 (n = 30)	73.9 (n = 85)
	0-5 years	21.6 (n = 8)	78.4 (n = 29)
27. … use mobile devices to connect to others for my professional development.	6-10 years	40.9 (n = 9)	59.1 (n = 13)
	11-20 years	22.6 (n = 7)	77.4 (n = 24)
	20+ years	56.0 (n = 14)	44.0 (n = 11)

	All	33.0 (n = 38)	67.0 (n = 77)
	0-5 years	5.4 (n = 2)	94.6 (n = 35)
28. … use mobile devices to have my students access learning activities.	6-10 years	36.4 (n = 8)	63.6 (n = 14)
	11-20 years	9.7 (n = 3)	90.3 (n = 28)
	20+ years	24.0 (n = 6)	76.0 (n = 19)
	All	16.5 (n = 19)	83.5 (n = 96)
	0-5 years	2.7 (n = 1)	97.3 (n = 36)
29. … download and listen to podcasts/audio books.	6-10 years	13.6 (n = 3)	86.4 (n = 19)
	11-20 years	3.2 (n = 1)	96.8 (n = 30)
	20+ years	4.0 (n = 1)	96.0 (n = 24)
	All	5.2 (n = 6)	94.8 (n = 109)
	0-5 years	5.4 (n = 2)	94.6 (n = 35)
30. … download and read e-books.	6-10 years	0.0 (n = 0)	100.0 (n = 22)
	11-20 years	3.2 (n = 1)	96.8 (n = 30)

	20+ years	8.0	92.0
		(n = 2)	(n = 23)
	All	4.3	95.7
		(n = 5)	(n = 110)
	0-5 years	2.7	97.3
31. … download and		(n = 1)	(n = 36)
view streaming	6-10 years	0.0	100.0
movies/video clips.		(n = 0)	(n = 22)
	11-20 years	0.0	100.0
		(n = 0)	(n = 31)
	20+ years	0.0	100.0
		(n = 0)	(n = 25)
	All	0.9	99.1
		(n = 1)	(n = 114)
	0-5 years	0.0	100.0
32. … send and receive		(n = 0)	(n = 37)
text messages.	6-10 years	0.0	100.0
		(n = 0)	(n = 22)
	11-20 years	0.0	100.0
		(n = 0)	(n = 31)
	20+ years	0.0	100.0
		(n = 0)	(n = 25)
	All	0.0	100.0
		(n = 0)	(n = 115)
	0-5 years	0.0	100.0
33. … transfer photos		(n = 0)	(n = 37)
or other data via a	6-10 years	0.0	100.0
smartphone.		(n = 0)	(n = 22)

	11-20 years	0.0	100.0
		(n = 0)	(n = 31)
	20+ years	4.0	96.0
		(n = 1)	(n = 24)
	All	0.9	99.1
		(n = 1)	(n = 114)
	0-5 years	0.0	100.0
34. … save and retrieve		(n = 0)	(n = 37)
files in a cloud-	6-10 years	4.5	95.5
based environment.		(n = 1)	(n = 21)
	11-20 years	0.0	100.0
		(n = 0)	(n = 31)
	20+ years	4.0	96.0
		(n = 1)	(n = 24)
	All	1.7	98.3
		(n = 2)	(n = 113)

Research Question 2

Research question two, Does early-childhood teachers' years of service (a) 0 –5 years of service, (b) 6–10 years of service, (c) 11-20 years of service, and (d) more than 20 years of service influence early-childhood teachers' attitudes towards technology?, was answered by conducting a one-way ANOVA to determine if there was a statistically significant mean difference among the four categories of years of service for early-childhood teachers. Results of the one-way ANOVA indicated early-childhood teachers' years of service does not influence early-childhood teachers' attitudes towards technology, $F(3, 111) = 2.52$, $p = .062$. In other words, an early-childhood teacher's attitude towards educational technology does not change based on years of service. Table 4.4 displays the one-way ANOVA results.

Table 4.6

One-Way ANOVA Results: Teachers' Attitudes Towards Technology

Years of Service	N	M	SD	F-value	df	p-value
0-5 years	37	84.49	7.68	2.52	(3, 111)	.062*
6-10 years	22	81.36	9.20			
11-20 years	31	84.42	10.07			
20+ years	25	79.32	6.14			

* Statistically Significant ($p < .05$)

Research question two was also measured using frequencies, percentages of the Attitude Toward Technology Scale (ATTS). The survey questionnaire relating years of service to overall attitude towards technology included 31-items using a 4-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree). The responses related to how years of service influenced overall attitude towards technology are provided below.

0-5 Years of Service

Early-childhood teachers with zero to five years of service had overall positive attitudes towards classroom educational technology use. The highest percentage of participants chose *Agree/Strongly Agree* about incorporating educational technology into any classroom subject (97.3%) and when considering if educational technology provides a useful classroom resource for teachers (100.0%). The highest percentage of participants chose *Disagree/Strongly Disagree* about if teaching and educational technology do not belong together (97.3%) and when considering if educational technology distracts from learning (97.3%). Additionally, most early-childhood teachers with zero to five years of experience did not think educational technology can be used to teach the most important

things (62.2%) but believed educational technology use in the classroom improves test scores (62.2%).

6–10 Years of Service

Early-childhood teachers with six to 10 years of service had varying attitudes towards classroom educational technology use. The highest percentage of participants chose *Agree/Strongly Agree* when considering if educational technology provides a useful classroom resource for teachers (100.0%). The highest percentage of participants chose *Disagree/Strongly Disagree* about if teaching and educational technology do not belong together (95.5%) and when considering if educational technology is only useful in teaching the most basic skills (95.5%). Participants were conflicted when considering if more educational technology in the classroom is a good thing (50.0% *Agree/Strongly Agree*, 50.0% *Disagree/Strongly Disagree*) and about educational technology improving thinking (50.0% *Agree/Strongly Agree*, 50.0% *Disagree/Strongly Disagree*). Additionally, most early-childhood teachers with six to 10 years of experience thought there is too much emphasis on educational technology in the classroom (63.6%) and time spend incorporating educational technology could be better spent teaching the basics (54.5%).

11-20 Years of Service

Early-childhood teachers with 11 to 20 years of service had overall positive attitudes towards classroom educational technology use. All participants chose *Agree/Strongly Agree* about incorporating educational technology into any classroom subject (100.0%) and when considering if educational technology provides a useful classroom resource for teachers (100.0%). The highest percentage of participants chose *Disagree/Strongly Disagree* when considering if teaching and educational technology belong together (96.8%). Additionally, most early-childhood teachers with 11 to 20 years

of experience thought incorporating educational technology into classroom activities is worth the effort required (90.3%) and believe educational technology use in the classroom improves test scores (51.6%).

20+ Years of Service

Early-childhood teachers with more than 20 years of service had varying attitudes towards classroom educational technology use. The highest percentage of participants chose *Agree/Strongly Agree* when considering if educational technology can be incorporated into any subject (96.0%) and if educational technology provides a useful classroom resource for teachers (96.0%). The highest percentage of participants chose *Disagree/Strongly Disagree* about teaching and educational technology do not belong together (92.0%) and when deciding if educational technology is only useful in teaching the most basic skills (96.0%). Additionally, most early-childhood teachers with more than 20 years of experience thought more educational technology in the classroom would not be a good thing (64.0%), educational technology in the classroom does not improve thinking (60.0%), the most important things can be taught using educational technology (56.0%), and the use of educational technology does not improve test scores (60.0%).

Total Years of Service Comparison

Overall attitudes towards educational technology use in early-childhood classrooms varied among years of service categories. Early-childhood teachers with six to 10 years of experience were the only category which believed time spent incorporating educational technology could be better spent teaching the basics and too much emphasis is put on educational technology in the classroom. Early-childhood teachers with zero to five years of service and early-childhood teachers with 11 to 20 years of experience believed more educational technology in the classroom is a good thing, educational technology improves thinking, and educational technology improves test scores; while

early-childhood teachers with more than 20 years of experience thought more educational technology in the classroom is not a good thing, does not improve thinking, and does not improve test scores.

Early-childhood teachers with six to 10 years of experience were divided in half concerning beliefs about educational technology being a good thing and educational technology improving thinking and did not think educational technology improves test scores. Early-childhood teachers with six to 10 years of service and early-childhood teachers with 11 to 20 years of experience believed most things cannot be taught using educational technology, while early-childhood teachers with zero to five years of experience and early-childhood teachers with more than 20 years of experience thought most things can be taught using educational technology. Tables 4.7 and 4.8 display the percentages and frequencies of participants with zero to 20+ years of service in expanded form and collapsed form respectively on overall attitude towards technology.

Table 4.7

Expanded Responses to Teachers' Attitudes Towards Technology for All Participants (%)

Survey Item		Strongly Disagree	Disagree	Agree	Strongly Agree
1. Students learn better when technology is included in their activities.	0-5 years	0.0 (n = 0)	10.8 (n = 4)	67.6 (n = 25)	21.6 (n = 8)
	6-10 years	4.5 (n = 1)	36.4 (n = 8)	40.9 (n = 9)	18.2 (n = 4)
	11-20 years	0.0 (n = 0)	9.7 (n = 3)	64.5 (n = 20)	25.8 (n = 8)
	20+ years	8.0 (n = 2)	40.0 (n = 10)	44.0 (n = 11)	8.0 (n = 2)
	All	2.6 (n = 3)	21.7 (n = 25)	56.5 (n = 65)	19.1 (n = 22)
2. Technology can be incorporated into any classroom subject.	0-5 years	0.0 (n = 0)	2.7 (n = 1)	40.5 (n = 15)	56.8 (n = 21)
	6-10 years	0.0 (n = 0)	18.2 (n = 4)	40.9 (n = 9)	40.9 (n = 9)
	11-20 years	0.0 (n = 0)	0.0 (n = 0)	41.9 (n = 13)	58.1 (n = 18)
	20+ years	0.0 (n = 0)	4.0 (n = 1)	60.0 (n = 15)	36.0 (n = 9)
	All	0.0 (n = 0)	5.2 (n = 6)	45.2 (n = 52)	49.6 (n = 57)
3. Time spent incorporating technology could be	0-5 years	2.7 (n = 1)	64.9 (n = 24)	27.0 (n = 10)	5.4 (n = 2)
	6-10 years	0.0 (n = 0)	45.5 (n = 10)	45.5 (n = 10)	9.1 (n = 2)

better spent teaching the basics.	11-20 years	6.5 (n = 2)	48.4 (n = 15)	38.7 (n = 12)	6.5 (n = 2)
	20+ years	4.0 (n = 1)	52.0 (n = 13)	28.0 (n = 7)	16.0 (n = 4)
	All	3.5 (n = 4)	53.9 (n = 62)	33.9 (n = 39)	8.7 (n = 10)
4. Technology allows a teacher to capture a student's interest.	0-5 years	0.0 (n = 0)	5.4 (n = 2)	62.2 (n = 23)	32.4 (n = 12)
	6-10 years	0.0 (n = 0)	13.6 (n = 3)	59.1 (n = 13)	27.3 (n = 6)
	11-20 years	0.0 (n = 0)	12.9 (n = 4)	58.1 (n = 18)	29.0 (n = 9)
	20+ years	4.0 (n = 1)	12.0 (n = 3)	56.0 (n = 14)	28.0 (n = 7)
	All	0.9 (n = 1)	10.4 (n = 12)	59.1 (n = 68)	29.6 (n = 34)
5. Technology costs schools more than it is worth.	0-5 years	21.6 (n = 8)	70.3 (n = 26)	5.4 (n = 2)	2.7 (n = 1)
	6-10 years	22.7 (n = 5)	40.9 (n = 9)	36.4 (n = 8)	0.0 (n = 0)
	11-20 years	25.8 (n = 8)	61.3 (n = 19)	6.5 (n = 2)	6.5 (n = 2)
	20+ years	12.0 (n = 3)	60.0 (n = 15)	28.0 (n = 7)	0.0 (n = 0)
	All	20.9 (n = 24)	60.0 (n = 69)	16.5 (n = 19)	2.6 (n = 3)

	0-5 years	0.0	8.1	59.5	32.4
6. The use of		(n = 0)	(n = 3)	(n = 22)	(n = 12)
technology in the	6-10 years	0.0	27.3	63.6	9.1
classroom improves		(n = 0)	(n = 6)	(n = 14)	(n = 2)
education.	11-20 years	0.0	12.9	58.1	29.0
		(n = 0)	(n = 4)	(n = 18)	(n = 9)
	20+ years	8.0	16.0	60.0	16.0
		(n = 2)	(n = 4)	(n = 15)	(n = 4)
	All	1.7	14.8	60.0	23.5
		(n = 2)	(n = 17)	(n = 69)	(n = 27)
	0-5 years	0.0	0.0	48.6	51.4
7. Technology provides		(n = 0)	(n = 0)	(n = 18)	(n = 19)
a useful classroom	6-10 years	0.0	4.5	59.1	36.4
resource for teachers.		(n = 0)	(n = 1)	(n = 13)	(n = 8)
	11-20 years	0.0	0.0	61.3	38.7
		(n = 0)	(n = 0)	(n = 19)	(n = 12)
	20+ years	4.0	0.0	64.0	32.0
		(n = 1)	(n = 0)	(n = 16)	(n = 8)
	All	0.9	0.9	57.4	40.9
		(n = 1)	(n = 1)	(n = 66)	(n = 47)
	0-5 years	18.9	73.0	8.1	0.0
8. Technology drains		(n = 7)	(n = 27)	(n = 3)	(n = 0)
school resources that	6-10 years	9.1	63.6	27.3	0.0
could be better used.		(n = 2)	(n = 14)	(n = 6)	(n = 0)
	11-20 years	22.6	61.3	9.7	6.5
		(n = 7)	(n = 19)	(n = 3)	(n = 2)
	20+ years	28.0	48.0	24.0	0.0
		(n = 7)	(n = 12)	(n = 6)	(n = 0)

	All	20.0 (n = 23)	62.6 (n = 72)	15.7 (n = 18)	1.7 (n = 2)
	0-5 years	0.0 (n = 0)	2.7 (n = 1)	37.8 (n = 14)	59.5 (n = 22)
9. Students get excited about technology in the classroom.	6-10 years	4.5 (n = 1)	4.5 (n = 1)	31.8 (n = 7)	59.1 (n = 13)
	11-20 years	0.0 (n = 0)	3.2 (n = 1)	35.5 (n = 11)	61.3 (n = 19)
	20+ years	4.0 (n = 1)	4.0 (n = 1)	48.0 (n = 12)	44.0 (n = 11)
	All	1.7 (n = 2)	3.5 (n = 4)	38.3 (n = 44)	56.5 (n = 65)
	0-5 years	0.0 (n = 0)	10.8 (n = 4)	59.5 (n = 22)	29.7 (n = 11)
10. Technology encourages students to learn on their own.	6-10 years	9.1 (n = 2)	22.7 (n = 5)	50.0 (n = 11)	18.2 (n = 4)
	11-20 years	0.0 (n = 0)	29.0 (n = 9)	41.9 (n = 13)	29.0 (n = 9)
	20+ years	0.0 (n = 0)	24.0 (n = 6)	68.0 (n = 17)	8.0 (n = 2)
	All	1.7 (n = 2)	20.9 (n = 24)	54.8 (n = 63)	22.6 (n = 26)
	0-5 years	10.8 (n = 4)	56.8 (n = 21)	29.7 (n = 11)	2.7 (n = 1)
11. There is too much emphasis on technology in the classroom.	6-10 years	4.5 (n = 1)	31.8 (n = 7)	18.2 (n = 4)	45.5 (n = 10)
	11-20 years	9.7 (n = 3)	45.2 (n = 14)	29.0 (n = 9)	16.1 (n = 5)

	20+ years	8.0	48.0	32.0	12.0
		(n = 2)	(n = 12)	(n = 8)	(n = 3)
	All	8.7	47.0	27.8	16.5
		(n = 10)	(n = 54)	(n = 32)	(n = 19)
	0-5 years	0.0	8.1	64.9	27.0
12. Technology in the		(n = 0)	(n = 3)	(n = 24)	(n = 10)
classroom enhances	6-10 years	0.0	13.6	68.2	18.2
student learning.		(n = 0)	(n = 3)	(n = 15)	(n = 4)
	11-20 years	0.0	6.5	58.1	35.5
		(n = 0)	(n = 2)	(n = 18)	(n = 11)
	20+ years	0.0	16.0	64.0	20.0
		(n = 0)	(n = 4)	(n = 16)	(n = 5)
	All	0.0	10.4	63.5	26.1
		(n = 0)	(n = 12)	(n = 73)	(n = 30)
	0-5 years	0.0	8.1	67.6	24.3
13. Incorporating		(n = 0)	(n = 3)	(n = 25)	(n = 9)
technology into	6-10 years	4.5	36.4	40.9	18.2
classroom activities		(n = 1)	(n = 8)	(n = 9)	(n = 4)
is worth the effort	11-20 years	0.0	9.7	61.3	29.0
required.		(n = 0)	(n = 3)	(n = 19)	(n = 9)
	20+ years	0.0	24.0	64.0	12.0
		(n = 0)	(n = 6)	(n = 16)	(n = 3)
	All	0.9	17.4	60.0	21.7
		(n = 1)	(n = 20)	(n = 69)	(n = 25)
	0-5 years	2.7	56.6	32.4	8.1
14. Technology can		(n = 1)	(n = 21)	(n = 12)	(n = 3)
solve many	6-10 years	18.2	36.4	36.4	9.1
classroom problems.		(n = 4)	(n = 8)	(n = 8)	(n = 2)

	11-20 years	3.2 (n = 1)	48.8 (n = 15)	35.5 (n = 11)	12.9 (n = 4)
	20+ years	8.0 (n = 2)	64.0 (n = 16)	28.0 (n = 7)	0.0 (n = 0)
	All	7.0 (n = 8)	52.2 (n = 60)	33.0 (n = 38)	7.8 (n = 9)
15. More technology in the classroom is a good thing.	0-5 years	0.0 (n = 0)	24.3 (n = 9)	62.2 (n = 23)	13.5 (n = 5)
	6-10 years	22.7 (n = 5)	27.3 (n = 6)	40.9 (n = 9)	9.1 (n = 2)
	11-20 years	0.0 (n = 0)	38.7 (n = 12)	41.9 (n = 13)	19.4 (n = 6)
	20+ years	8.0 (n = 2)	56.0 (n = 14)	28.0 (n = 7)	8.0 (n = 2)
	All	6.1 (n = 7)	35.7 (n = 41)	45.2 (n = 52)	13.0 (n = 15)
16. Technology in the classroom improves thinking.	0-5 years	0.0 (n = 0)	32.4 (n = 12)	54.1 (n = 20)	13.5 (n = 5)
	6-10 years	18.2 (n = 4)	31.8 (n = 7)	36.4 (n = 8)	13.6 (n = 3)
	11-20 years	3.2 (n = 1)	25.8 (n = 8)	54.8 (n = 17)	16.1 (n = 5)
	20+ years	12.0 (n = 3)	48.0 (n = 12)	32.0 (n = 8)	8.0 (n = 2)
	All	7.0 (n = 8)	33.9 (n = 39)	46.1 (n = 53)	13.0 (n = 15)

	0-5 years	0.0 (n = 0)	5.4 (n = 2)	67.6 (n = 25)	27.0 (n = 10)
17. Technology in the classroom helps students learn.	6-10 years	9.1 (n = 2)	9.1 (n = 2)	68.2 (n = 15)	13.6 (n = 3)
	11-20 years	0.0 (n = 0)	12.9 (n = 4)	74.2 (n = 23)	12.9 (n = 4)
	20+ years	4.0 (n = 1)	36.0 (n = 9)	6.0 (n = 15)	0.0 (n = 0)
	All	2.6 (n = 3)	12.2 (n = 14)	68.7 (n = 79)	16.5 (n = 19)
	0-5 years	0.0 (n = 0)	18.9 (n = 7)	56.8 (n = 21)	24.3 (n = 9)
18. Technology improves teaching.	6-10 years	0.0 (n = 0)	27.3 (n = 6)	54.5 (n = 12)	18.2 (n = 4)
	11-20 years	3.2 (n = 1)	25.8 (n = 8)	54.8 (n = 17)	16.1 (n = 5)
	20+ years	32.0 (n = 8)	60.0 (n = 15)	8.0 (n = 2)	0.0 (n = 0)
	All	1.7 (n = 2)	26.1 (n = 30)	56.5 (n = 65)	72.0 (n = 18)
	0-5 years	37.8 (n = 14)	59.5 (n = 22)	2.7 (n = 1)	0.0 (n = 0)
19. Teaching and technology do not belong together.	6-10 years	27.3 (n = 6)	54.5 (n = 12)	13.6 (n = 3)	4.5 (n = 1)
	11-20 years	41.9 (n = 13)	54.8 (n = 17)	0.0 (n = 0)	3.2 (n = 1)

	20+ years	32.0	60.0	8.0	0.0
		(n = 8)	(n = 15)	(n = 2)	(n = 0)
	All	35.7	57.4	5.2	1.7
		(n = 41)	(n = 66)	(n = 6)	(n = 2)
	0-5 years	13.5	83.8	2.7	0.0
20. Technology		(n = 5)	(n = 31)	(n = 1)	(n = 0)
distracts from	6-10 years	9.0	77.3	13.6	0.0
learning.		(n = 2)	(n = 17)	(n = 3)	(n = 0)
	11-20 years	29.0	54.8	12.9	3.2
		(n = 9)	(n = 17)	(n = 4)	(n = 1)
	20+ years	20.0	52.0	28.0	0.0
		(n = 5)	(n = 13)	(n = 7)	(n = 0)
	All	18.3	67.8	13.0	0.9
		(n = 21)	(n = 78)	(n = 15)	(n = 1)
	0-5 years	2.7	8.1	62.2	27.0
21. Every classroom		(n = 1)	(n = 3)	(n = 23)	(n = 10)
should make use of	6-10 years	4.5	13.6	56.0	16.0
technology.		(n = 1)	(n = 3)	(n = 14)	(n = 4)
	11-20 years	0.0	19.4	54.8	25.8
		(n = 0)	(n = 6)	(n = 17)	(n = 8)
	20+ years	0.0	16.0	60.0	24.0
		(n = 0)	(n = 4)	(n = 15)	(n = 6)
	All	1.7	13.9	60.0	24.3
		(n = 2)	(n = 16)	(n = 69)	(n = 28)

	0-5 years	18.9	56.8	13.5	10.8
22. Technology should		(n = 7)	(n = 21)	(n = 5)	(n = 4)
be part of all	6-10 years	31.8	50.0	18.2	0.0
classroom		(n = 7)	(n = 11)	(n = 4)	(n = 0)
assignments.	11-20 years	16.1	61.3	16.1	6.5
		(n = 5)	(n = 19)	(n = 5)	(n = 2)
	20+ years	16.0	64.0	20.0	0.0
		(n = 4)	(n = 16)	(n = 5)	(n = 0)
	All	20.0	58.3	16.5	5.2
		(n = 23)	(n = 67)	(n = 19)	(n = 6)
	0-5 years	0.0	13.5	70.3	16.2
23. Technology is		(n = 0)	(n = 5)	(n = 26)	(n = 6)
making classrooms	6-10 years	9.1	13.6	59.1	18.2
more appealing to		(n = 2)	(n = 3)	(n = 13)	(n = 4)
students.	11-20 years	0.0	25.8	54.8	19.4
		(n = 0)	(n = 8)	(n = 17)	(n = 6)
	20+ years	4.0	24.0	72.0	0.0
		(n = 1)	(n = 6)	(n = 18)	(n = 0)
	All	2.6	19.1	64.3	13.9
		(n = 3)	(n = 22)	(n = 74)	(n = 16)
	0-5 years	16.2	73.0	10.8	0.0
24. Technology is a		(n = 6)	(n = 27)	(n = 4)	(n = 0)
threat to "real"	6-10 years	4.5	72.7	22.7	0.0
learning.		(n = 1)	(n = 16)	(n = 5)	(n = 0)

	11-20 years	19.4	71.0	6.5	3.2
		(n = 6)	(n = 22)	(n = 2)	(n = 1)
	20+ years	16.0	60.0	20.0	4.0
		(n = 4)	(n = 15)	(n = 5)	(n = 1)
	All	14.8	69.6	13.9	1.7
		(n = 17)	(n = 80)	(n = 16)	(n = 2)
	0-5 years	13.5	48.6	35.1	2.7
25. The most important		(n = 5)	(n = 18)	(n = 13)	(n = 1)
things cannot be	6-10 years	0.0	45.5	40.9	13.6
taught using		(n = 0)	(n = 10)	(n = 9)	(n = 3)
technology.	11-20 years	12.9	35.5	41.9	9.7
		(n = 4)	(n = 11)	(n = 13)	(n = 3)
	20+ years	8.0	48.0	36.0	8.0
		(n = 2)	(n = 12)	(n = 9)	(n = 2)
	All	9.6	44.3	38.3	7.8
		(n = 11)	(n = 51)	(n = 44)	(n = 9)
	0-5 years	16.2	78.4	5.4	0.0
26. Technology is only		(n = 6)	(n = 29)	(n = 2)	(n = 0)
useful in teaching	6-10 years	22.7	72.7	4.5	0.0
the most basic skills.		(n = 5)	(n = 16)	(n = 1)	(n = 0)
	11-20 years	9.7	83.9	0.0	6.5
		(n = 3)	(n = 26)	(n = 0)	(n = 2)
	20+ years	24.0	72.0	4.0	0.0
		(n = 6)	(n = 18)	(n = 1)	(n = 0)

	All	17.4 (n = 20)	77.4 (n = 89)	3.5 (n = 4)	1.7 (n = 2)
	0-5 years	0.0 (n = 0)	10.8 (n = 4)	73.0 (n = 27)	16.2 (n = 6)
27. The use of technology in the classroom can revitalize education.	6-10 years	9.1 (n = 2)	27.3 (n = 6)	59.1 (n = 13)	4.5 (n = 1)
	11-20 years	0.0 (n = 0)	22.6 (n = 7)	61.3 (n = 19)	16.1 (n = 5)
	20+ years	4.0 (n = 1)	28.0 (n = 7)	68.0 (n = 17)	0.0 (n = 0)
	All	2.6 (n = 3)	20.9 (n = 24)	66.1 (n = 76)	10.4 (n = 12)
	0-5 years	0.0 (n = 0)	37.8 (n = 14)	54.1 (n = 20)	8.1 (n = 3)
28. The use of technology in the classroom improves test scores.	6-10 years	22.7 (n = 5)	31.8 (n = 7)	45.5 (n = 10)	0.0 (n = 0)
	11-20 years	0.0 (n = 0)	48.4 (n = 15)	41.9 (n = 13)	9.7 (n = 3)
	20+ years	4.0 (n = 1)	56.0 (n = 14)	40.0 (n = 10)	0.0 (n = 0)
	All	5.2 (n = 6)	43.5 (n = 50)	46.1 (n = 53)	5.2 (n = 6)

	0-5 years	10.8	75.7	8.1	5.4
29. The benefits of		(n = 4)	(n = 28)	(n = 3)	(n = 2)
technology to	6-10 years	4.5	59.1	31.8	4.5
education are		(n = 1)	(n = 13)	(n = 7)	(n = 1)
overrated.	11-20 years	16.1	58.1	22.6	3.2
		(n = 5)	(n = 18)	(n = 7)	(n = 1)
	20+ years	8.0	52.0	32.0	8.0
		(n = 2)	(n = 13)	(n = 8)	(n = 2)
	All	10.4	62.6	21.7	5.2
		(n = 12)	(n = 72)	(n = 25)	(n = 6)
	0-5 years	0.0	24.3	59.5	16.2
30. The use of		(n = 0)	(n = 9)	(n = 22)	(n = 6)
technology in the	6-10 years	4.5	13.6	72.7	9.1
classroom can		(n = 1)	(n = 3)	(n = 16)	(n = 2)
benefit all students.	11-20 years	0.0	16.1	58.1	25.8
		(n = 0)	(n = 5)	(n = 18)	(n = 8)
	20+ years	4.0	12.0	72.0	12.0
		(n = 1)	(n = 3)	(n = 18)	(n = 3)
	All	1.7	17.4	64.3	16.5
		(n = 2)	(n = 20)	(n = 74)	(n = 19)
	0-5 years	0.0	10.8	62.2	27.0
31. The use of		(n = 0)	(n = 4)	(n = 23)	(n = 10)
technology in the	6-10 years	4.5	18.2	72.7	4.5
classroom improves		(n = 1)	(n = 4)	(n = 16)	(n = 1)
teaching.					

11-20 years	0.0	22.6	51.6	25.8
	(n = 0)	(n = 7)	(n = 16)	(n = 8)
20+ years	12.0	28.0	56.0	4.0
	(n = 3)	(n = 7)	(n = 14)	(n = 1)
All	3.5	19.1	60.0	17.4
	(n = 4)	(n = 22)	(n = 69)	(n = 20)

Table 4.8

Collapsed Responses to Teachers' Attitudes Towards Technology for All Participants (%)

Survey Item		Strongly Disagree/Disagree	Agree/Strongly Agree
1. Students learn better when technology is included in their activities.	0-5 years	10.8 (n = 4)	89.2 (n = 33)
	6-10 years	40.9 (n = 9)	59.1 (n = 13)
	11-20 years	9.7 (n = 3)	90.3 (n = 28)
	20+ years	48.0 (n = 12)	52.0 (n = 13)
	All	24.3 (n = 28)	75.7 (n = 87)
2. Technology can be incorporated into any classroom subject.	0-5 years	2.7 (n = 1)	97.3 (n = 36)
	6-10 years	18.2 (n = 4)	81.8 (n = 18)
	11-20 years	0.0 (n = 0)	100.0 (n = 31)

	20+ years	4.0	96.0
		(n = 1)	(n = 24)
	All	5.2	94.8
		(n = 6)	(n = 109)
	0-5 years	67.6	32.4
3. Time spent		(n = 25)	(n = 12)
incorporating	6-10 years	45.5	54.5
technology could be		(n = 10)	(n = 12)
better spent teaching	11-20 years	54.8	45.2
the basics.		(n = 17)	(n = 14)
	20+ years	56.0	44.0
		(n = 14)	(n = 11)
	All	57.4	42.6
		(n = 66)	(n = 49)
	0-5 years	5.4	94.6
4. Technology allows a		(n = 2)	(n = 35)
teacher to capture a	6-10 years	13.6	81.8
student's interest.		(n = 3)	(n = 18)
	11-20 years	12.9	87.1
		(n = 4)	(n = 27)
	20+ years	16.0	84.0
		(n = 4)	(n = 21)
	All	11.3	88.7
		(n = 13)	(n = 102)
	0-5 years	91.9	8.1
5. Technology costs		(n = 34)	(n = 3)
schools more than it is	6-10 years	63.6	36.4
worth.		(n = 14)	(n = 8)

	11-20 years	87.1	12.9
		(n = 27)	(n = 4)
	20+ years	72.0	28.0
		(n = 18)	(n = 7)
	All	80.9	19.1
		(n = 93)	(n = 22)
	0-5 years	8.1	91.9
6. The use of technology		(n = 3)	(n = 34)
in the classroom	6-10 years	27.3	72.7
improves education.		(n = 6)	(n = 16)
	11-20 years	12.9	87.1
		(n = 4)	(n = 27)
	20+ years	24.0	76.0
		(n = 6)	(n = 19)
	All	16.5	83.5
		(n = 19)	(n = 96)
	0-5 years	0.0	100.0
7. Technology provides a		(n = 0)	(n = 37)
useful classroom	6-10 years	4.5	95.5
resource for teachers.		(n = 1)	(n = 21)
	11-20 years	0.0	100.0
		(n = 0)	(n = 31)
	20+ years	4.0	96.0
		(n = 1)	(n = 24)
	All	1.7	98.3
		(n = 2)	(n = 113)
	0-5 years	91.9	8.1
		(n = 34)	(n = 3)

8. Technology drains school resources that could be better used.	6-10 years	72.7 (n = 16)	27.3 (n = 6)
	11-20 years	83.9 (n = 26)	16.1 (n = 5)
	20+ years	76.0 (n = 19)	24.0 (n = 6)
	All	82.6 (n = 95)	17.4 (n = 20)
	0-5 years	2.7 (n = 1)	97.3 (n = 36)
9. Students get excited about technology in the classroom.	6-10 years	9.1 (n = 2)	90.9 (n = 20)
	11-20 years	3.2 (n = 1)	96.8 (n = 30)
	20+ years	8.0 (n = 2)	92.0 (n = 23)
	All	5.2 (n = 6)	94.8 (n = 109)
	0-5 years	10.8 (n = 4)	89.2 (n = 33)
10. Technology encourages students to learn on their own.	6-10 years	31.8 (n = 7)	68.2 (n = 15)
	11-20 years	29.0 (n = 9)	71.0 (n = 22)
	20+ years	24.0 (n = 6)	76.0 (n = 19)
	All	22.6 (n = 26)	77.4 (n = 89)

	0-5 years	67.6	32.4
11. There is too much		(n = 25)	(n = 12)
emphasis on	6-10 years	36.4	63.6
technology in the		(n = 8)	(n = 14)
classroom.	11-20 years	54.8	45.2
		(n = 17)	(n = 14)
	20+ years	56.0	44.0
		(n = 14)	(n = 11)
	All	55.7	44.3
		(n = 64)	(n = 51)
	0-5 years	8.1	91.9
12. Technology in the		(n = 3)	(n = 34)
classroom enhances	6-10 years	13.6	86.4
student learning.		(n = 3)	(n = 19)
	11-20 years	6.5	93.5
		(n = 2)	(n = 29)
	20+ years	16.0	84.0
		(n = 4)	(n = 21)
	All	10.4	89.6
		(n = 12)	(n = 103)
	0-5 years	8.8	91.9
13. Incorporating		(n = 3)	(n = 34)
technology into	6-10 years	40.9	59.1
classroom activities is		(n = 9)	(n = 13)
worth the effort	11-20 years	9.7	90.3
required.		(n = 3)	(n = 28)
	20+ years	24.0	76.0
		(n = 6)	(n = 19)

	All	18.3	81.7
		(n = 21)	(n = 94)
	0-5 years	59.5	40.5
14. Technology can solve		(n = 22)	(n = 15)
many classroom	6-10 years	54.5	45.5
problems.		(n = 12)	(n = 10)
	11-20 years	51.6	48.4
		(n = 16)	(n = 15)
	20+ years	72.0	28.0
		(n = 18)	(n = 7)
	All	59.1	40.9
		(n = 68)	(n = 47)
	0-5 years	24.3	75.7
15. More technology in		(n = 9)	(n = 28)
the classroom is a	6-10 years	50.0	50.0
good thing.		(n = 11)	(n = 11)
	11-20 years	38.7	61.3
		(n = 12)	(n = 19)
	20+ years	64.0	36.0
		(n = 16)	(n = 9)
		41.7	58.3
	All	(n = 48)	(n = 67)
	0-5 years	32.4	67.6
16. Technology in the		(n = 12)	(n = 25)
classroom improves	6-10 years	50.0	50.0
thinking.		(n = 11)	(n = 11)
	11-20 years	29.0	71.0
		(n = 9)	(n = 22)

	20+ years	60.0 (n = 15)	40.0 (n = 10)
	All	40.9 (n = 47)	59.1 (n = 68)
17. Technology in the classroom helps students learn.	0-5 years	5.4 (n = 2)	94.6 (n = 35)
	6-10 years	18.2 (n = 4)	81.8 (n = 18)
	11-20 years	12.9 (n = 4)	87.1 (n = 27)
	20+ years	28.0 (n = 7)	72.0 (n = 18)
	All	14.8 (n = 17)	85.2 (n = 98)
18. Technology improves teaching.	0-5 years	18.9 (n = 7)	81.1 (n = 30)
	6-10 years	27.3 (n = 6)	72.7 (n = 16)
	11-20 years	29.0 (n = 9)	71.0 (n = 22)
	20+ years	40.0 (n = 10)	60.0 (n = 15)
	All	27.8 (n = 32)	72.2 (n = 83)
19. Teaching and technology do not belong together.	0-5 years	97.3 (n = 36)	2.7 (n = 1)
	6-10 years	81.8 (n = 18)	18.2 (n = 4)

	11-20 years	96.8	3.2
		(n = 30)	(n = 1)
	20+ years	92.0	8.0
		(n = 23)	(n = 2)
	All	93.0	7.0
		(n = 107)	(n = 8)
	0-5 years	97.3	2.7
20. Technology distracts		(n = 36)	(n = 1)
from learning.	6-10 years	86.4	13.6
		(n = 19)	(n = 3)
	11-20 years	83.9	16.1
		(n = 26)	(n = 5)
	20+ years	72.0	28.0
		(n = 18)	(n = 7)
	All	86.1	13.9
		(n = 99)	(n = 16)
	0-5 years	10.8	89.2
21. Every classroom		(n = 4)	(n = 33)
should make use of	6-10 years	18.2	81.8
technology.		(n = 4)	(n = 18)
	11-20 years	19.4	80.6
		(n = 6)	(n = 25)
	20+ years	16.0	84.0
		(n = 4)	(n = 21)
	All	15.7	84.3
		(n = 18)	(n = 97)

	0-5 years	75.7	24.3
22. Technology should be		(n = 28)	(n = 9)
part of all classroom	6-10 years	81.8	18.2
assignments.		(n = 18)	(n = 4)
	11-20 years	77.4	22.6
		(n = 24)	(n = 7)
	20+ years	80.0	20.0
		(n = 20)	(n = 5)
	All	78.3	21.7
		(n = 90)	(n = 25)
	0-5 years	13.5	86.5
23. Technology is making		(n = 5)	(n = 32)
classrooms more	6-10 years	22.7	77.3
appealing to students.		(n = 5)	(n = 17)
	11-20 years	25.8	74.2
		(n = 8)	(n = 23)
	20+ years	28.0	72.0
		(n = 7)	(n = 18)
	All	21.7	78.3
		(n = 25)	(n = 90)
	0-5 years	78.4	10.8
24. Technology is a threat		(n = 29)	(n = 4)
to "real" learning.	6-10 years	77.3	22.7
		(n = 17)	(n = 5)
	11-20 years	90.3	9.7
		(n = 28)	(n = 3)
	20+ years	76.0	24.0
		(n = 19)	(n = 6)

	All	84.3	15.7
		(n = 97)	(n = 18)
	0-5 years	62.2	37.8
25. The most important		(n = 23)	(n = 14)
things cannot be	6-10 years	45.5	54.5
taught using		(n = 10)	(n = 12)
technology.	11-20 years	48.4	51.6
		(n = 15)	(n = 16)
	20+ years	56.0	44.0
		(n = 14)	(n = 11)
	All	53.9	46.1
		(n = 62)	(n = 53)
	0-5 years	94.6	5.4
26. Technology is only		(n = 35)	(n = 2)
useful in teaching the	6-10 years	95.5	4.5
most basic skills.		(n = 21)	(n = 1)
	11-20 years	93.5	6.5
		(n = 29)	(n = 2)
	20+ years	96.0	4.0
		(n = 24)	(n = 1)
	All	94.8	5.2
		(n = 109)	(n = 6)
	0-5 years	10.8	89.2
27. The use of technology		(n = 4)	(n = 33)
in the classroom can	6-10 years	36.4	63.6
revitalize education.		(n = 8)	(n = 14)
	11-20 years	22.6	77.4
		(n = 7)	(n = 24)

	20+ years	32.0	68.0
		(n = 8)	(n = 17)
	All	23.5	76.5
		(n = 27)	(n = 88)
	0-5 years	37.8	62.2
28. The use of technology		(n = 14)	(n = 23)
in the classroom	6-10 years	54.5	45.5
improves test scores.		(n = 12)	(n = 10)
	11-20 years	48.4	51.6
		(n = 15)	(n = 16)
	20+ years	60.0	40.0
		(n = 15)	(n = 10)
	All	48.7	51.3
		(n = 56)	(n = 59)
	0-5 years	86.5	13.5
29. The benefits of		(n = 32)	(n = 5)
technology to	6-10 years	63.6	36.4
education are		(n = 14)	(n = 8)
overrated.	11-20 years	74.2	25.8
		(n = 23)	(n = 8)
	20+ years	60.0	40.0
		(n = 15)	(n = 10)
	All	73.0	27.0
		(n = 84)	(n = 31)
	0-5 years	24.3	75.7
30. The use of technology		(n = 9)	(n = 28)
in the classroom can	6-10 years	18.2	81.8
benefit all students.		(n = 4)	(n = 18)

	11-20 years	16.1	83.9
		(n = 5)	(n = 26)
	20+ years	16.0	84.0
		(n = 4)	(n = 21)
	All	19.1	80.9
		(n = 22)	(n = 93)
	0-5 years	10.8	89.2
31. The use of technology		(n = 4)	(n = 33)
in the classroom	6-10 years	22.7	77.3
improves teaching.		(n = 5)	(n = 17)
	11-20 years	22.6	77.4
		(n = 7)	(n = 24)
	20+ years	40.0	60.0
		(n = 10)	(n = 15)
	All	22.6	77.4
		(n = 26)	(n = 89)

Research Question 3

Research question three, Is there a statistically significant relationship between early-childhood teachers' technology proficiency and early-childhood teachers' attitudes towards technology?, was answered by conducting Pearson's product moment correlations (r) between early-childhood teachers' technology proficiency and early-childhood teachers' attitudes towards technology. Results of the Pearson's (r) indicated there was a statistically significant positive relationship between an early-childhood teacher's technology proficiency and their attitudes toward technology, $r = .227$, $r^2 = .052$, $p = .015$. As an early-childhood teacher's technology proficiency increases, his or her attitude towards technology also increases. Approximately 5.2% of the variance in an early-childhood teacher's technology proficiency score can be attributed to the overall

attitude towards technology an early-childhood teacher possesses. Table 4.9 provides a description of statistical data.

Table 4.9

Pearson's (r): Teachers' Technology Proficiency and Attitude Towards Technology

Survey Type	N	M	SD	r-value	p-value	r^2- value
Composite TPSA Score	115	117.49	13.02	.227	.015*	.052
Composite ATT Score	115	82.75	8.58			

* Statistically Significant ($p < .05$)

Research Question 4

Research question four, What are the perceptions of early-childhood teachers about the use and developmental appropriateness of educational technology in early-childhood classrooms as it relates to their years of service?, was answered using a thematic analysis method of organizing responses to 10 interviews. Participants were given the opportunity to answer 15 semi-structured interview questions and freely elaborate on their opinions about educational technology use in early-childhood classrooms. As a result, six overall themes emerged with two sub-themes further explaining one of the main themes. To answer this research question, the following themes emerged from the analysis process: (a) types of technology including sub theme apps and programs used and reasons for use (b) selection strategies (c) skills taught by utilized technology (d) professional development/training (e) beliefs about technology use and (f) developmentally appropriate practices (DAP). The research findings for these themes are explained in more detail below.

Types of Technology

All interview participants use technology in their classrooms in some way. Most of the teachers use a Smartboard and iPads in their classroom and two participants

reported taking their students to the campus computer lab to utilize the abundance of computers available for all students to use at the same time. Wanda, a Kindergarten teacher with two years of experience in education, reported, "…we also go to the computer labs every Tuesday, and we do half, uh 30 minutes IStation and then 30 minutes Dreambox".

For most of the teachers the Smartboard was used for whole-group mini-lessons and music and movement breaks, especially on rainy days when students cannot go outside for recess. Two teachers also allowed students to utilize the Smartboard during station rotations. Bailey, a Kindergarten teacher with 15 years of experience in education, reported, "…and the Smartboard I might use for things like tracing letters or something like that." Additionally, Wanda, who also teaches Kindergarten, said:

> So, I use my Smartboard for incorporating videos into lessons for songs. Um, I also use it for hands-on things. We do the um, Smart Exchange where they can match things. They can use it to write on. Um, we use the Smartboard for a lot of things. They [the students] can even use the Smartboard independently during PAW time.

In addition, all teachers described using iPads in their classrooms. Sutton, a Kindergarten teacher with 18 years of experience in education, reported using both the Smartboard and iPads during instruction:

> So, for the Smartboard we use um, different websites and things. Like, there's one that has different math manipulatives, um, virtual math manipulatives that the kids can use. And then we use like Starfall and you know stuff like that for calendar and ABC's. Um, on our iPads, we use Dreambox. We use My On, which is a new reading app that they've...um, the district has gotten for us this year. We

> use um, Chatterpix, See Saw, Draw and Tell. There are several um, individual apps for the different math manipulatives…and some games and stuff.

Using the Smartboard for large group instruction and iPads for independent work seemed most popular among the participants no matter how many years of experience they held. The one computer in the classroom was mainly used by the teacher, but more desktop computers were utilized by students in campus computer labs. Teacher participants went on to describe the apps or programs they used with their classroom technology.

Apps and Programs Used. Many different types of apps and programs were mentioned during conducted interviews. The district uses a program called Dreambox for mathematical instruction and assessments and IStation for reading instruction and assessments. To add to this, Bailey stated:

> Well, a lot of it would be, usually something that is directed from the district like, we're required to use Dreambox, so I use that in the computer lab. Uh, also IStation. I would use that in the computer lab. Also, I use those same programs on the iPad.

Additionally, Kennedy, a first-year teacher stated, "That [Dreambox] helps with um, their practice as well, because it meets them where they are. It doesn't even let them go past certain levels um, if they can't grasp the um, concept".

It was noted that Pre-Kindergarten students are not required to use these programs, as they follow different guidelines than Kindergarten and first grade students. In addition, Astrid, a Pre-Kindergarten teacher with over 20 years of experience in education stated:

> I use some apps, um, that I load on our iPads that are from the district um, self-service, and I choose the ones that target early-childhood. So, like letter tracing, or alphabet identification, nursery rhymes, so forth. Um, but our kids are so tech-

> savvy that they go around those and it's a constant battle. I have kids who are able to navigate and get on to YouTube and are watching things on YouTube, or they're playing with the camera, versus doing the activities that I feel like could maybe benefit them. So, they [the students] are not even really getting the benefit of those apps because they're doing other things on the iPads.

Other teachers reported using additional apps and programs, such as Starfall and ABCya. Gwen reported, "Um, on the iPads they [the students] will use Starfall or ABCya, different apps that help with, um, working on numeracy or letter identification, literacy". Likewise, Bailey also described using ABCya: "So, the early part of the year, right now I have the kids using like Starfall ABCs. So, like just that particular app, and learning their ABCs. But Math, I would use Dreambox".

While Starfall and ABCya seemed popular, other apps and programs were incorporated as well. For example, Wanda stated, "…when they [the students] go on iPads, they listen to Unite for Literacy, and they watch the words light up as it reads it, and they hear the words read to them…". For another example, Sawyer, a first grade teacher with three years of early-childhood experience stated, "So…I like to use, Nearpod is one of my favorites, um technologies…just because it's a mixture of like a PowerPoint and something for the students to be interactive with… it's very interactive and hands-on…which is what I love." Regardless of the name of the apps or programs incorporated into their instruction, all four of the teacher participants were looking for ways to enhance literacy and numeracy skills. They shared many other reasons for using technology as well.

Reasons for Use. Although all 10 teachers reported using educational technology, many different reasons for its use were given. For example, Gwen stated, "I believe that technology should be used as a resource to extend or further develop education. I believe

first line instruction with the teacher is the most important thing, but it can be an extension or just um, a supportive tool". In addition to using educational technology as an extension to instruction, Wanda uses educational technology as independent practice while she pulls small groups; Bailey finds technology especially helpful when assessments are due because it is engaging and quiet. Despite teachers' years of experience, engagement and support were the most reported reasons for using educational technology in early-childhood classrooms.

Selection Strategies

During the interview process, participants were asked how they decided what technology apps and programs to use in their classrooms. All teachers reported wanting programs that were age-appropriate, easy to use, and engaging, as shared by Gwen:

> Part of it is based on what's appropriate age wise. So, since they're four and five years old, what they're used to using, what they're capable of using, and what's easy to follow without a teacher being right next to them to direct them.

Fiona, a first-year teacher also reported:

> Um, knowing my class, knowing my kids is important. I think that there's a lot of kids that aren't ready to take that step with technology, but also there's kids that are more exposed to it and then kids that are not exposed to it at home. So, just kind of going day-to-day and seeing what would help them with the lessons.

As a result, many teacher participants discussed trying out the apps first before allowing the students to use them. For instance, Wanda reported:

> I kind of listen to what other teachers suggested as well. Um, I've had other teachers from trainings suggest different apps. I've had teachers from throughout the school suggest different apps. And I try it out before I let them [the students]

use it. That way I can see how it works, and everything, and if I can understand it, they can understand it.

Teacher participants found it important to choose apps and programs with purpose and meaning, making sure to hit TEKS objectives. One participant, Astrid shared the following:

> …when I'm looking at a lesson, when I'm planning a lesson, I look at what the objective is, and um, from then I decide what's the best way to teach that lesson, and if I feel like technology is needed, then I'll implement it within that lesson…it helps to find things that meet the objective, but also are going to be engaging for the kids, to get them excited.

Another participant discussed educational technology use during team planning. Sawyer stated, "I try to bring it [educational technology] up during planning with my team first, and my coach….um, to see if it's something that they're, they're interested in doing as well. And, if it will be rigorous enough to hit the TEK for the students." As a result, relevance to learning objectives gleaned important when choosing educational technology applications and programs in early-childhood classrooms.

Skills Taught by Utilized Technology

When discussing educational technology use in early-childhood classrooms, it is important to know what skills are taught through chosen apps and programs. Teacher participants were very quick to report not using technology just for the sake of using it. Most of the participants expressed the desire to enhance learning through apps and programs, which teach necessary foundational skills needed for success with academic concepts. During one of the interviews, Bailey shared:

> Um, well I think especially for English language, ELA, it's important to have some sort of oral component. So, I like things that either like read the book, or

> like using it as a listening station, like on the iPad, having a station where you can actually look and listen to a book, or have it read to you, where maybe like the words are highlighted. Uh, or something that, um, has catchy songs, like for the alphabet, or something that can, that they can learn with. And they have also like tracing letters too. So, I think that's important.

On the contrary, two teachers felt technology was not the proper way to teach foundational skills, but rather early-childhood students need more conventional approaches to learning. For example, Norah, who has 21 years of experience as an early-childhood teacher, believes:

> Um, I think it [technology] is beneficial if it's used in small amounts. I mean I think you really have to look at screen time and the age of the children. Um, and that it just needs to be in small amounts. And if it's engaging…um…you know…then it's good…if it helps their learning. But I think that hands-on is always a better choice if we can…and that can kind of…we can incorporate a small amount of technology in it…but you know…but that's kind of my last resort…yeah.

This opinion supports the idea of being purposeful in choosing how and when educational technology is implemented in early-childhood classrooms.

Professional Development/Training

Participants were asked two questions about professional development and trainings for educational technology in early-childhood classrooms. The first question asked what trainings participants had received on implementing educational technology in early-childhood classrooms. Most teacher participants commented on the lack of trainings, or the ineffectiveness of trainings offered by the district. For example, Fiona expressed her frustration by stating, "Um, honestly, I haven't received much training on

the technology that I use in my classroom. I kind of just taught myself." Gwen expressed her frustration by stating:

> So, for [this district], the only thing that has been available so far, other than using the tech specialist that comes once a week, which I just haven't figured out how to use. Um, there was a specific Pre-K – K app training that was given during the summer, of apps that are suggested to use. Um, so, Pre-K has Touchtronics and something else that I can't think of. I personally don't like them that much though. So, my kids aren't using them because it is hard to get them to physically maneuver those pieces and get it to react with the iPad.

Additionally, Bailey discussed the following about summer training sessions stating:

> Uh, I personally attended I think one or two [trainings] over the summer, just kind of telling you about different apps that you could use in your classroom, and training you, relatively vaguely on how you can use them, or some interesting aspects of them…

Astrid also commented on technology training not being beneficial by reporting, "Um, I know there's a lot of technology trainings available. I do not go to a lot of them. Um, I just feel that a lot of them are not necessary to be used in my classroom. So, I choose not to go to them".

Participants also shared thoughts on whether it would be beneficial to receive professional development training on how to implement developmentally appropriate technology in their classroom. Answers to this question varied among teacher participants. One participant, Kennedy, reported:

> Um, I would like something [training] where…they [professional development trainers] can walk me through how to use the app with the kids. Um, because sometimes, there are things that we kind of get and like, I don't know what to do

> with it. So…I think that would be helpful…if they could walk us through um, like, what to use and how to use with the kids, and all the features that the app has.

Additionally, Cameron, a first-grade teacher with four years of early-childhood teaching experience, expresses a desire for hands-on training, "Um, I think a training on…how to use the different technology. But, um, something that I would have to do myself. Like, I can't, I can't have somebody show me how to do it…I have to do it."

Regardless of their years of teaching experience, all teacher participants thought additional training would be beneficial; however, they demonstrated mixed feelings about the need for additional technology implementation within early-childhood classrooms. While some were not opposed, others felt more strongly against it. For example, Astrid shared, "I'm sure I would benefit from going to technology in-services. Um, as far as implementing more educational technology in my classroom, I don't feel like it would necessarily be developmentally appropriate". More opinions about educational technology use in early-childhood classrooms are expressed further below.

Beliefs about Technology Use

Like their opinions on professional development, teacher participants also shared very candid beliefs about using educational technology in early-childhood classrooms. Most teachers thought of it as an appropriate supplement for instruction, while one participant strongly expressed concerns about its detriments to students' growth and development. Furthermore, despite varying teaching experience in early-childhood, participants shared mixed feelings about the benefits educational technology brings to early-childhood classrooms. Newer early-childhood teachers, such as Sawyer, Kennedy, and Cameron felt technology use and skills are an essential part of education and should be used in the classroom as much as possible. Sawyer stated her opinion with conviction:

> Oh, I feel like we have to use technology. Nowadays um, kids are always on their IPads (Laugh). It's uh, I guess their attention span, from what I'm seeing recently, is that it's getting a little shorter than what I remember when I was a kid. Um, but they're definitely more interested and more motivated with technology. Um, especially if it's like educational games. Um, something that looks like a regular game, but it's hidden in there that they have to do some of Reading or Math activity. Um, so I feel like it definitely has to be some sort of staple in the classroom. Um, also fun for the teacher. You know…whatever lesson is that you're trying to deliver…they're more…I feel like they're more engaged or more interested if you're using technology that they're familiar with, that they want to play around with too.

The fourth participant, Gwen, who has eight years of experience working with early-childhood students, reported, "I believe that technology should be used as a resource to extend or further develop education. I believe first line instruction with the teacher is the most important thing, but it can be an extension or just um, a supportive tool". Additionally, Bailey, who has five years of experience working with early-childhood students, expressed confliction:

> Part of me likes it. The other part of me thinks, ugh. Well then, and part of me likes it because um, of its high engagement level, because it does keep the kids engaged and focused on one particular task. Whereas, other hands-on manipulative type games…which is probably better for early-childhood…actually working on fine-motor skills and doing problem-solving. Having to think and cooperate with others, as opposed to just sitting and staring at a screen.

The third participant, Astrid, who has 10 years of experience working with early-childhood students, shared a different perspective:

> To me, I believe that most of the learning should be um, in small groups. It should be hands-on, um, developing fine-motor skills, listening skills, um, interactive social skills, and I feel like that technology does not lend itself to a lot of those skills that I feel are important…I think kids having real objects in their hands, more books in their hands, um, are much more beneficial then to use an electronic device.

This opinion supports the idea of making sure educational technology use in early-childhood classrooms is not detrimental to students' learning and development.

Developmentally Appropriate Practices (DAP)

For the purpose of this study, Developmentally Appropriate Practices (DAP) refers to perceived theoretical practices deemed as age appropriate for early-childhood settings (Blake et al., 2011). Teacher participants were asked questions about what DAP means to them, if they use DAP when choosing technology, and how they decide if apps or programs they are using are developmentally appropriate. Sutton, who has 15 years of early-childhood experience, expressed the following:

> If…again the kids. If um, if they have too difficult of a time manipulating whatever it is that they're supposed to do when they're in it, then obviously it's not developmentally appropriate for them, and I'll find something else. Or if it's too easy and they're just zipping through it, again not developmentally appropriate, find something else.

Although answers varied among participants, they all shared a conviction for doing what's developmentally appropriate for early-childhood students. For example, Bailey expressed the following about DAP:

> To me that [DAP] would be something that is like proven, something that is like research proven, like this is something that will help the kids. Uh, that this will

> help develop whatever it is that you're trying to develop. You know, if it's fine motor skills, that it will help develop those. If it's acquiring oral language, then it's more effective using this. It's something that is research based.

Finally, teacher participants with 20 or more years of experience felt strongly against educational technology being developmentally appropriate for early-childhood students. For example, Astrid delivered this warning:

> I think that we have to be careful with how much we're implementing, especially with younger ages. Um, because as I said, they [the students] are exposed to so much technology, that it is really having an adverse effect on their relationships and their development. And um, research has shown that, and so, I really try to limit that…what I can control in the classroom, because I can't control what is happening outside the classroom. So, I want to make sure they're getting experiences in the classroom that are going to um, help them develop other skills that are important for early childhood.

Educational technology is widely utilized in early-childhood classrooms; however, research from this study depicts mixed beliefs and perceptions from early-childhood teachers. Regardless of their years of experience, early-childhood teachers do not always believe educational technology is developmentally appropriate or the best means of instruction. Additionally, teacher participants expressed concern for the lack of training towards effectively implementing educational technology in early-childhood classrooms.

Summary of Findings

Chapter IV provided an analysis of both the quantitative and qualitative data collected during the study to address the four research questions. Surveys were sent via email to 640 early-childhood teachers within the school district and ten interviews were

conducted to glean additional knowledge. A purposeful sample of 115 early-childhood teachers was collected from the 640 emails to answer the survey. The participants teach either Pre-kindergarten, Kindergarten, or first grade. Additionally, most survey participants are female between the ages of 31 and 40 years of age with bachelor's degrees.

An analysis of the quantitative data collected with the TPSA C21 revealed a statistically significant influence of early-childhood teachers' years of service on technology proficiency. In addition, results of the Tukey Post Hoc for question one indicated statistically significant mean differences between 11-20 years of service and 20+ years of service categories. Furthermore, data analysis of information collected with the ATTS revealed no statistically significant influence of participants' years of service on early-childhood teachers' attitudes towards technology, and the results of the Tukey Post Hoc for question two indicated no significant mean differences between any of the early-childhood teachers' years of service categories. Finally, question three measured with a Pearson's (r), determined an early-childhood teacher's attitude towards technology increases, as his or her technology proficiency increases.

An analysis of qualitative data collected during 10 interviews with early-childhood teachers yielded more information on teachers' perceptions of using educational technology in their classrooms as it relates to their years of service. The research collected through the interview process showed teachers beliefs and concerns were candid, regardless of their years of experience. Additionally, despite years of service, all teacher participants felt technology use in early-childhood classrooms is beneficial to a point but should not replace hands-on and/or conventional activities. Additionally, all participants felt purposeful and hands-on professional development, tailored to early-childhood students, would be beneficial.

Conclusion

In conclusion, the results of the one-way ANOVAs conducted for questions one and two indicated a statically significant difference between an early-childhood teacher's years of service and their technology proficiency, but did not indicate a statically significant difference between an early-childhood teacher's years of service and their attitude towards technology. Question three revealed a statistically significant positive relationship between an early-childhood teacher's technology proficiency and their attitudes toward technology. Additionally, the qualitative data indicated teachers do not perceive educational technology differently depending on their experience within early-childhood classroom settings. The analyzation of these findings will be discussed further within Chapter V.

CHAPTER V:

SUMMARY, IMPLICATIONS, AND RECOMMENDATIONS

The purpose of this study was to investigate the influence of early-childhood teachers' perceptions, attitudes, and technology proficiency on educational technology use in early-childhood classrooms. To quantify perceptions and seek greater insight in this area, 115 early-childhood (pre-Kindergarten through first-grade) teachers employed in a large suburban school district in Southeastern Texas completed the *Technology Proficiency Self-Assessment for 21st Century Learning* (TPSA C21) and *Attitude Toward Technology Scale* (ATTS). Additionally, 10 elementary school teachers, who teach in early-childhood grades, participated in semi-structured interviews. The qualitative data enhanced the understanding of early-childhood teachers' attitudes, perceptions, and technology proficiency regarding the use of educational technology in early-childhood classrooms. This chapter will contextualize the study within the larger body of research. Furthermore, implications for early-childhood teachers, campus/district administrators, and campus/district policy will be discussed. This chapter will conclude with recommendations for future research.

Summary

Research Question 1

Research question one, Does early-childhood teachers' years of service (a) 0–5 years of service, (b) 6–10 years of service, (c) 11-20 years of service, and (d) more than 20 years of service influence early-childhood teachers' technology proficiency?, was answered by conducting a one-way ANOVA to determine if there was a statistically significant mean difference in early-childhood teachers' technology proficiency among the four categories of years of service for early-childhood teachers and analyzing quantitative data collected from the Technology Proficiency Self-Assessment for 21st

Century Learning (TPSA C21) survey. In addition, frequencies and percentages of the survey were broken down into four different categorical ranges by years of service. Results of the one-way ANOVA indicated early-childhood teachers' years of service does influence early-childhood teachers' technology proficiency, $F(3, 111) = 3.5$, $p = .019$, omega-squared (w^2) = .06, eta-squared (η^2) = .09. Early-childhood teachers with more years of service are more likely to feel confident in their proficiency with technology skills, resulting in higher implementation in their early-childhood classrooms. A study by Tweed (2013) contradicted these findings, revealing teacher age, years of teaching experience, teacher gender, and technology professional development hours did not have a statistically significant influence on teachers' self-efficacy; however, teachers' self-efficacy was significantly positively related to classroom technology use. These findings reaffirm the importance for early-childhood teachers to be technologically proficient to increase educational technology use in early-childhood classrooms.

Results of this study are affirmed by Hsu (2016), who found teachers with strong technology self-efficacy, were more consistent with personal technology use and demonstrated more effective educational technology implementation within a classroom setting. This is also reflective of the research conducted by Kent and Giles (2017). Participants completed a course on how to integrate meaningful technology tools in early-childhood classrooms, further highlighting the need for clear expectations and training on implementation of educational technology in early-childhood classrooms. Results determined teachers need strong technology proficiency to effectively implement educational technology in early-childhood classrooms.

The current study also found, early-childhood teachers across all years of service categories reported an overall proficiency of personal technology use. A lack of proficiency was reported when considering creating a web page for early-childhood

teachers with more than 20 years of experience (68.0%); creating a wiki or blog for early-childhood teachers with six to 10 years of experience (63.6%) and more than 20 years of experience (64.0); and using mobile devices to connect to others for professional development for early-childhood teachers with more than 20 years of experience (56.0%). Additionally, a change in technology proficiency in the highest years of service category (20+ years of service) was exposed. There was a decrease in technology proficiency between 11-20 years of service and 20+ years of service. This might be caused by a difference in or lack of professional development supporting educational technology within those years of service categories. This is supported through a research study conducted by Keengwe and Onchwari (2009), which found a need for schools to provide clear direction and support for teachers to meet technology goals. Additionally, the study noted a correlation between strong professional development and appropriate integration of educational technology in early-childhood classrooms. This correlation is also supported in the research by Belo et al. (2016), which determined technology proficiency, through quality programs, is imperative when selecting quality educational technology in early-childhood classrooms. The findings in both the current study and past research reinforce the need for quality training and technology proficiency when considering the use of educational technology in early-childhood classrooms.

Research Question 2

Research question two, Does early-childhood teachers' years of service (a) 0–5 years of service, (b) 6–10 years of service, (c) 11-20 years of service, and (d) more than 20 years of service influence early-childhood teachers' attitudes towards technology?, was answered by conducting a one-way ANOVA to determine if there was a statistically significant mean difference among the four categories of years of service for early-childhood teachers and analyzing quantitative data collected from the Attitude Toward

Technology Scale (ATTS) survey. In addition, frequencies and percentages of the survey were broken down into four different categorical ranges by years of service. Results of the one-way ANOVA indicated early-childhood teachers' years of service do not influence early-childhood teachers' attitudes towards technology. Early-childhood teachers' attitudes towards educational technology do not change based on years of service.

Research conducted by Kulik and Kulik (1991) examined past studies of teachers from all different backgrounds and years of service, about using Computer Based Instruction (CBI) in their classrooms. Teachers in the study found students in CBI classes out-performed traditionally taught students, revealing positive attitudes towards the benefits of using technology in classrooms. These results are also partly affirmed by Hatzigianni and Kalaizidis (2018), which found early-childhood teachers and directors with different years of service, all showed a change in their attitudes towards educational technology and were more confident and open to the idea of implementing technology lessons in early-childhood classrooms.

While the current study did not find an influence between years of service and teachers' attitudes towards educational technology, overall attitudes towards educational technology use in early-childhood classrooms varied among years of service categories. Additionally, teachers in all years of service categories had strong convictions about implementing educational technology. For example, early-childhood teachers with zero to five years of service and early-childhood teachers with 11 to 20 years of experience believed more educational technology in the classroom is advantageous, educational technology improves thinking, and educational technology improves test scores; while early-childhood teachers with more than 20 years of experience thought more educational technology in the classroom is not beneficial, does not improve thinking, and does not

improve test scores. These results are confirmed by Nikolopoulou and Gialamas (2010), who conducted a study to investigate the difference between in-service and pre-service teachers' views (attitudes) and intentions about integrating educational technology in early-childhood settings. Results indicated, despite whether teachers were pre-service (0 years of service) and in-service (various years of service), a strong correlation between teachers' attitudes towards educational technology and their intention of using it in their classrooms.

In another study by Seraji et al. (2017) researchers found a statistically significant relationship between three constructs, including teachers' tenure, experience, and age regarding teachers' attitudes towards technology. Congruently with the current, this study highlighted the importance of experience and teachers' attitudes towards technology implementation. Additionally, McKinley (2014) found teacher demographics including tenure (years of service), did not influence teachers' attitudes towards technology; however, a strong correlation between professional development training and positive attitudes towards technology existed. These finding resulted in the development of professional development sessions to better support implementation of educational technology in classroom curriculum. The results of the current study indicated teachers have strong attitudes about implementing educational technology in their classrooms despite years of service. These results imply a causation of attitudes towards educational technology and need for quality professional development, which are explored more in the questions below.

Research Question 3

Research question three, Is there a statistically significant relationship between early-childhood teachers' technology proficiency and early-childhood teachers' attitudes towards technology?, was answered by conducting Pearson's product moment

correlations (r) between early-childhood teachers' technology proficiency and early-childhood teachers' attitudes towards technology and analyzing quantitative data between early-childhood teachers' technology proficiency and early-childhood teachers' attitudes towards technology, using both the TPSA C21 and the ATTS. Results of the Pearson's (r) indicated there was a statistically significant positive relationship between an early-childhood teacher's technology proficiency and their attitudes toward technology, $r = .227$, $r^2 = .052$, $p = .015$. As an early-childhood teacher's technology proficiency increases, his or her attitude towards technology also increases.

These findings are consistent with a study conducted by Giles (2016), which found a positive correlation between teachers' perceived attitudes, proficiency, and technology knowledge on their intentions to use educational technology within the classroom setting. In addition, findings in this study highlighted the importance of proper training methods for all teachers to increase technology proficiency and attitudes towards technology use. In addition, a study conducted by Yilmaz and Alici (2011) also attributed training to increases in overall positivity towards Computer Based Education (CBE). Past research confirms the importance of training and exposure on early-childhood teachers' attitudes towards CBE or educational technology usage in early-childhood classrooms. Furthermore, Preradovic' and Boras (2017), indicated teachers who were comfortable with personal use of technology, had positive attitudes towards implementing educational technology in their classrooms, while recognizing potential dangers of students acquiring a general dependence on technology.

Two studies referenced the TPACK, which explains what educators need to teach concepts within a subject area using technology. It is important to note, educators need strong technology proficiency to decipher TPACK domains. Abbitt (2011) confirmed the current study's findings of technology proficiency influencing attitudes towards

educational technology implementation. The study found knowledge of TPACK domains strongly correlated to self-efficacy about technology use. Additionally, Abbitt (2011) found technology knowledge (proficiency) resulted in higher implementation of educational technology in a classroom setting. The second TPACK study conducted by Altun (2019), indicated pre-service teachers' attitudes towards and usage of technology were associated with their TPACK competencies as well. These findings indicate a need to help early-childhood teachers refine their theoretical knowledge and practice in their educational technology integration, resulting in more positive attitudes towards educational technology use.

Research Question 4

Research question four, What are the perceptions of early-childhood teachers about the use and developmental appropriateness of educational technology in early-childhood classrooms as it relates to their years of service?, was answered using a thematic analysis method of organizing responses to 10 interviews. As a result, six overall themes emerged with two sub-themes further explaining one of the main themes. To answer this research question, the following themes emerged from the analysis process: (a) types of technology including sub theme apps and programs used and reasons for use (b) selection strategies (c) skills taught by utilized technology (d) professional development/training (e) beliefs about technology use and (f) developmentally appropriate practices (DAP). The research collected through the interview process showed teachers' beliefs and concerns were candid, regardless of their years of experience. Additionally, despite years of service, all teacher participants felt technology use in early-childhood classrooms is beneficial to a point but should not replace hands-on and/or conventional activities. The research findings for these themes are explained in more detail below.

Masoumi (2015), found mixed perceptions of how educational technology should be implemented in early-childhood classrooms. Like the current study, findings indicated apps and programs are a good enhancement to traditional teaching. Early-childhood educators who participated in the current study used Ipads, Smartboards, and the school's computer lab to enhance learning and not to replace first-line instruction. This is also indicative of a study conducted by Beschorner and Hutchison (2013), who found educational technology should be used to enhance foundational skills.

Furthermore, teachers in the current study select educational technology based on criteria such as, ease of use, effectiveness, and engagement. Educators also felt there was an appropriate time and place for educational technology integration, and selecting appropriate technology is important for growth and development. This is congruent with Belo et al. (2016), who acknowledged the importance of selecting quality educational technology in early-childhood classrooms. In addition, Tondeur et al. (2015), found using effective educational technology in appropriate ways and at appropriate times throughout daily instruction is most beneficial for early-childhood students.

Many educators who participated in the current study reported using educational technology to teach or reinforce basic skills. Most of the participants expressed the desire to enhance learning through apps and programs which teach necessary foundational skills such as alphabet letters and sounds; however, two teachers felt technology was not the proper way to teach foundational skills, but rather early-childhood students need more conventional approaches to learning. These perceptions are reinforced through a study led by Pepper (2014) who revealed NMEC kindergarten teachers' wide acceptance of a child-centered teaching philosophies. Additionally, despite high curricular demands, data from the study showed teachers supported DAP, regardless of their levels of education or years of teaching experience. This study reiterated the importance of DAP in early-

childhood curriculum. In another study regarding appropriate early-childhood curriculum, Magen-Nagar and Firstater (2018), discovered a more passive role for educational technology in early-childhood classrooms. Educators who participated in the study used educational technology during free play and did not realize the potential of educational technology use. It is also important to note the desire for better professional development mentioned in the study. This desire was also felt by participants in the current study.

Most teacher participants in the current study commented on the lack of training, or the ineffectiveness of professional development offered by the district. Additionally, thoughts on the benefits of receiving professional development training on how to implement developmentally appropriate technology in their classroom varied among teacher participants. Regardless of their years or teaching experience, all teacher participants thought additional training would be beneficial; however, they demonstrated mixed feelings about the need for additional technology implementation within early-childhood classrooms. These findings are consistent with findings from Kara and Cagiltay (2017), which indicated educators were aware of the advantages and disadvantages of educational technology use in preschools (early-childhood) classrooms but chose to focus on the positives. Educators expressed the need for professional development and support from administration. Participants wanted their opinions on educational technology use and implementation to be heard and considered. Furthermore, Yilmaz and Alici (2011) attributed teachers' positive attitudes and willingness to use educational technology to quality training.

Educators who participated in the current study also shared very candid beliefs about using educational technology in early-childhood classrooms. As mentioned above, most teachers thought of it as an appropriate supplement for instruction. These views are similar to the findings in a study conducted by Mertala (2017), which concluded

educators' perceptions of educational technology were positive if implementation supported but did not replace main teaching methods. Additionally, research of Masoumi (2015) and Beschorner and Hutchinson (2013) also supported the use of educational technology as enhancements to traditional learning of foundational skills. Furthermore, despite various levels of teaching experience, participants shared mixed feelings about the benefits educational technology brings to early-childhood classrooms, and one participant strongly expressed concerns about its detriments to students' growth and development. This opinion was also expressed by research from Hatzigianni and Kalaizidis (2018), who found more research is needed to explore effects of educational technology on brain development. In addition, less than 20% of professional educators who participated in the research study of Blake et al. (2011) considered educational technology appropriate for early-childhood settings. A more recent study by Smith et al. (2014) expanded on these findings to include DAP. Results of the study showed while most participants were confident with personal technology skills and possessed positive attitudes about technology integration, many did not feel prepared to successfully implement effective, developmentally appropriate educational technology in a classroom setting.

Finally, although answers varied among the current study's participants, they all shared a conviction for doing what's developmentally appropriate for early-childhood students. Some participants expressed disdain for educational technology as a Developmentally Appropriate Practice (DAP), while others perceived educational technology implementation as DAP, depending on quality and effectiveness. These perceptions coincide with Moawad (2017), who found educational technology games do not affect early-childhood students' self-concept as it pertains to DAP if phonemic awareness skills are taught traditionally. A study by Alghazo and Al-Hilawani (2010),

also showed the importance of effectively teaching DAP skills with or without educational technology. These findings correspond to perceptions of the current study's participants who feel quality instruction should be the most important goal in all early-childhood classrooms.

Implications

As a result of the study's examination of early-childhood teachers' attitudes, perceptions, and technology proficiency regarding the use of educational technology in early-childhood classrooms, implications for early-childhood teachers, campus/district administrators, and campus/district policies emerged. This study revealed the need for teachers to feel competent in their abilities to use educational technology in early-childhood classrooms, despite their years of service. Additionally, campus/district administrators need to provide quality and effective professional development and hands-on practice of educational technology, to encourage early-childhood teachers to provide developmentally appropriate lessons, while still adhering to the use of educational technology experiences expected within 21st century learning. Furthermore, campus and district policies should recognize, include, and promote the need for developmentally appropriate use of educational technology in early-childhood curriculum.

Implications for Early-childhood Teachers

Early-childhood educators who strive to do what is best for their students must design developmentally appropriate lessons. In addition, 21st century learning requires the use of educational technology to keep up with demands of current technology expectations. As a result, it is imperative for educators to seek advice from colleagues and experts on how to implement quality, effective, and developmentally appropriate educational technology curriculum throughout the day. Additionally, participating in professional development which teaches technology skills is essential to developing the

technology proficiency levels necessary for positive attitudes and perspectives regarding educational technology use. Furthermore, despite years of service or experience level, it is crucial for early-childhood teachers to decipher if chosen educational technology meets DAP requirements. Quality professional development created specifically for early-childhood teachers will better address these needs.

Participants in this study discussed the need to try applications and programs before implementing them in a classroom setting or using them with students. Therefore, educators must take the opportunity to research and explore different types of educational technology, apps, and programs to ensure they are easily accessible, engaging, and effective. Furthermore, early-childhood educators must feel confident in teacher lead activities using technology, especially when teaching foundational or essential skills. The need for exceptional educational technology is heightened with the onset of the COVID-19, worldwide pandemic. The role of teachers changed during the crisis. Teachers were made to implement meaningful educational experiences to their students through unfamiliar technology tools (Kaden, 2020). Now more early-childhood students are participating in virtually learning, with most teaching occurring via educational technology. Consequently, it is vital for early-childhood teachers to possess a more extensive expertise in the discovery, implementation, and evaluation of developmentally appropriate educational technology use in early-childhood classrooms.

Implications for Campus/District Administrators

Expectations for 21st century learning include effective use of educational technology in every classroom. As a result, administrators both at the campus level and district level must make quality educational technology available to all educators, especially those in early-childhood classrooms. Additionally, administrators must also reflect on how to best meet teachers' needs regarding educational technology use.

Teachers must have access to effective professional development sessions with hands-on strategies, allowing exploration and practice of different devices, apps, and programs. Administrators should also model a growth mindset by obtaining essential technology proficiencies and possessing positive attitudes and perceptions towards quality educational technology implementation. Furthermore, administrators should encourage early-childhood educators to set goals and standards towards implementing exceptional educational technology lessons and providing quality educational technology for student use. The current times require all educators to utilize an unprecedented amount of educational technology in their classrooms daily. Consequently, it is imperative for administrators to prepare teachers for success. It is no longer an option for educators to use educational technology just to check a box on their evaluation,

Implications for Campus/District Policy

It is imperative for campuses and districts to reevaluate policies on implementing educational technology in early-childhood classrooms. COVID-19 has changed the way educational technology is utilized in all classrooms, especially Pre-K through first grade. Teachers are overwhelmed by new technology standards and expectations needed to ensure students participating in virtual learning still have access to exceptional learning opportunities. Additionally, participants in the current study revealed the lack of professional development, resulting in self-taught skills. As a result, district policy must ensure educators are being provided with the training and support they need. While online professional development is helpful, it does not always provide the level of training needed for high-level proficiency. Furthermore, campuses need more technology experts available to model, teach, and mentor teachers on how to use newly required devices and programs. Support at the campus and district levels can provide early-childhood educators with encouragement needed to implement educational technology

lessons while still adhering to DAP foundations. With educational technology expectations on the rise due to the pandemic, policy changes could be the key to early-childhood educators' success.

Recommendations for Future Research

Findings from this study gleaned both quantitative and qualitative perspectives from early-childhood teachers (pre-kindergarten through first grade). Data in this study include analysis of participants' attitudes, perceptions, and technology proficiency and serve as a basis for future research recommendations. It is recommended for future research to expand the potential population. Data were only collected within a large suburban school district in Southeastern Texas and therefore cannot be generalized for populations outside of the district. It would be valuable to conduct additional research in districts of various sizes and geographic locations. Collected data could reveal similar or different results based on a school district's location and demographics.

Expanding the knowledge base to include data from teachers in higher grade-levels, such as second through fifth grades at the elementary level and secondary levels (Junior High/Middle School and High School) is an additional recommendation for future research. Given data from the current study only analyzed quantitative and qualitative information from early-childhood teachers, it would be beneficial to investigate similarities or differences between teachers servicing students in higher-level grades. The attitudes, perceptions, and technology proficiency of teachers from different educational levels may yield various results based on the grade taught.

Collecting data from different stakeholders' perspectives may also offer an idea for future research. Understanding how administrators feel about using educational technology in early-childhood classrooms would help guide teachers in pursuing professional development and with creating quality lessons plans which involve

meaningful educational technology. Additionally, it would be beneficial for future research to explore various ways for early-childhood teachers to gain technology proficiency through professional development opportunities as well as from colleagues and other professionals.

Students from higher grades might also offer beneficial perceptions about using educational technology in classrooms. Comparing educational technology lessons to real world experiences could provide ideas for future research considerations. Gaining students' perspectives would allow teachers a new lens into engaging and quality educational technology lessons.

It is important to note that questions in the ATTS instrument do not completely align to early-childhood practices. Future research should consider adapting questions within the survey tool to include more early-childhood friendly educational apps and technology tools, such as Chatterpix. This will also help ensure questions are more fitting for DAP alignment when considering educational technology implementation in early-childhood curriculum.

Finally, the recent global pandemic has catapulted educators into unknown territory involving various forms of educational technology. Future research should compare early-childhood teachers' attitudes, perceptions, and technology proficiency from before the COVID-19 pandemic to educational practices within the post pandemic setting. Educational technology use is more prevalent in current times due to virtual learning and now more than ever, early-childhood educators are charged with implementing more meaningful and substantial educational technology lessons, and therefore need more professional development and support.

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APPENDIX A:

TEACHER SURVEY COVER LETTER

University
of Houston
Clear Lake

August 2019

Dear Early-Childhood Teacher:

Greetings! You are being solicited to complete the *Attitude Toward Technology Scale* (ATTS)/*Technology Proficiency Self-Assessment for 21st Century Learning* (TPSA C21) survey. The purpose of this study is to investigate the influence of early-childhood teachers' perceptions, attitudes, and technology proficiency on educational technology use in early-childhood classrooms. The data obtained from this study will not only help understand how educational technology should be used in early-technology classrooms, but also to glean knowledge of how to aid early-childhood teachers with its implementation.

Please try to answer all the questions. Filling out the attached survey is entirely voluntary but answering each response will make the survey most useful. This survey will take approximately 10 minutes to complete and all of your responses will be kept completely confidential. No obvious undue risks will be endured, and you may stop your participation at any time. In addition, you will also not benefit directly from your participation in the study.

Your cooperation is greatly appreciated and your willingness to participate in this study is implied if you proceed with completing the survey. Your completion of the *Attitude Toward Technology Scale* (ATTS)/*Technology Proficiency Self-Assessment for 21st Century Learning* (TPSA C21) survey is not only greatly appreciated, but invaluable. If you have any further questions, please feel free to contact Dr. Michelle Peters [redacted] or myself [redacted] Thank you!

Sincerely,

Angela P. Plut
The University of Houston – Clear Lake
College of Education
[redacted]

APPENDIX B:

TEACHER CONSENT FORM

Informed Consent to Participate in Research

You are being asked to participate in the research project described below. Your participation in this study is entirely voluntary and you may refuse to participate, or you may decide to stop your participation at any time. Should you refuse to participate in the study or should you withdraw your consent and stop participation in the study, your decision will involve no penalty or loss of benefits to which you may be otherwise entitled. You are being asked to read the information below carefully and ask questions about anything you don't understand before deciding whether or not to participate.

Title: The Influence of Early-Childhood Teachers - Perceptions, Attitudes and Technology Proficiency on Educational Technology Use

Student Investigator(s): Angela Plut, COE, Doctoral Student

Faculty Sponsor: Dr. Michelle Peters, COE

PURPOSE OF THE STUDY

The purpose of this study is to investigate the influence of early-childhood teachers' perceptions, attitudes, and technology proficiency on educational technology use in early-childhood classrooms.

PROCEDURES

You will be asked to participate in interviews face-to-face. During the interview, questions will be posed regarding your technology proficiency, perceptions of developmentally appropriate practices (DAP), and educational technology implementation. Interviews will last approximately 30 minutes and be recorded for accuracy of the transcription process.

EXPECTED DURATION

The total anticipated time commitment will be approximately 10 minutes for the survey and an additional 30 minutes for teachers who participate in the interview.

RISKS OF PARTICIPATION

There are no anticipated risks associated with participation in this project.

BENEFITS TO THE SUBJECT

There is no direct benefit received from your participation in this study, but your participation will help the investigator(s) better understand how early-childhood teachers implement educational technology in early-childhood classrooms.

CONFIDENTIALITY OF RECORDS

Every effort will be made to maintain the confidentiality of your study records. The data collected from the study will be used for educational and publication purposes, however, you will not be identified by name. For federal audit purposes, the participant's documentation for this research project will be maintained and safeguarded by the Faculty Sponsor for a minimum of three years after completion of the study. After that time, the participant's documentation may be destroyed.

FINANCIAL COMPENSATION

There is no financial compensation to be offered for participation in the study.

INVESTIGATOR'S RIGHT TO WITHDRAW PARTICIPANT

The investigator has the right to withdraw you from this study at any time.

CONTACT INFORMATION FOR QUESTIONS OR PROBLEMS

If you have additional questions during the course of this study about the research or any related problem, you may contact the Student Researcher, Angela Plut, at [redacted] or by email at [redacted]. The Faculty Sponsor Michelle Peters, Ed.D., may be contacted at [redacted] or by [redacted]

SIGNATURES:

Your signature below acknowledges your voluntary participation in this research project. Such participation does not release the investigator(s), institution(s), sponsor(s) or granting agency(ies) from their professional and ethical responsibility to you. By signing the form, you are not waiving any of your legal rights.

The purpose of this study, procedures to be followed, and explanation of risks or benefits have been explained to you. You have been allowed to ask questions and your questions have been answered to your satisfaction. You have been told who to contact if you have additional questions. You have read this consent form and voluntarily agree to participate as a subject in this study. You are free to withdraw your consent at any time by contacting the Principal Investigator or Student Researcher/Faculty Sponsor. You will be given a copy of the consent form you have signed.

Subject's printed name: _____

Signature of Subject: _____

Date: _____

Using language that is understandable and appropriate, I have discussed this project and the items listed above with the subject.

Printed name and title _____

Signature of Person Obtaining Consent: _____

Date: _____

THE UNIVERSITY OF HOUSTON-CLEAR LAKE (UHCL) COMMITTEE FOR PROTECTION OF HUMAN SUBJECTS HAS REVIEWED AND APPROVED THIS PROJECT. ANY QUESTIONS REGARDING YOUR RIGHTS AS A RESEARCH SUBJECT MAY BE ADDRESSED TO THE UHCL COMMITTEE FOR THE PROTECTION OF HUMAN SUBJECTS (281-283-3015). ALL RESEARCH PROJECTS THAT ARE CARRIED OUT BY INVESTIGATORS AT UHCL ARE GOVERNED BY REQUIREMENTS OF THE UNIVERSITY AND THE FEDERAL GOVERNMENT. (FEDERALWIDE ASSURANCE # FWA00004068)

APPENDIX C:

ATTITUDE TOWARD TECHNOLOGY SCALE

Attitude Toward Technology Scale

Each statement below refers to technology in the classroom. For the purpose of this scale, no distinction is made between hardware and software in the statements. Do not evaluate the items on the basis of whether they are factual, simply use the scale to provide your degree of agreement or disagreement with each statement.

Please read each statement carefully and circle the point on the scale that most accurately describes your level of agreement or disagreement.

		Strongly Disagree				Strongly Agree
1.	Students learn better when technology is included in their activities.	SD	D	N	A	SA
2.	Technology can be incorporated into any classroom subject.	SD	D	N	A	SA
3.	Time spent incorporating technology could be better spent teaching the basics.	SD	D	N	A	SA
4.	Technology allows a teacher to capture a student's interest.	SD	D	N	A	SA
5.	Technology costs schools more than it is worth.	SD	D	N	A	SA
6.	The use of technology in the classroom improves education.	SD	D	N	A	SA
7.	Technology provides a useful classroom resource for teachers.	SD	D	N	A	SA
8.	Technology drains school resources that could be better used.	SD	D	N	A	SA
9.	Students get excited about technology in the classroom.	SD	D	N	A	SA
10.	Technology encourages students to learn on their own.	SD	D	N	A	SA
11.	There is too much emphasis on technology in the classroom.	SD	D	N	A	SA
12.	Technology in the classroom enhances student learning.	SD	D	N	A	SA
13.	Incorporating technology into classroom activities is worth the effort required.	SD	D	N	A	SA
14.	Technology can solve many classroom problems.	SD	D	N	A	SA
15.	More technology in the classroom is a good thing.	SD	D	N	A	SA
16.	Technology in the classroom improves thinking.	SD	D	N	A	SA
17.	Technology in the classroom helps students learn.	SD	D	N	A	SA
18.	Technology improves teaching.	SD	D	N	A	SA
19.	Teaching and technology do not belong together.	SD	D	N	A	SA
20.	Technology distracts from learning.	SD	D	N	A	SA
21.	Every classroom should make use of technology.	SD	D	N	A	SA
22.	Technology should be part of all classroom assignments.	SD	D	N	A	SA
23.	Technology is making classrooms more appealing to students.	SD	D	N	A	SA
24.	Technology is a threat to "real" learning.	SD	D	N	A	SA
25.	The most important things can not be taught using technology.	SD	D	N	A	SA
26.	Technology is only useful in teaching the most basic skills.	SD	D	N	A	SA
27.	The use of technology in the classroom can revitalize education.	SD	D	N	A	SA
28.	The use of technology in the classroom improves test scores.	SD	D	N	A	SA
29.	The benefits of technology to education are overrated.	SD	D	N	A	SA
30.	The use of technology in the classroom can benefit all students.	SD	D	N	A	SA
31.	The use of technology in the classroom improves teaching.	SD	D	N	A	SA

APPENDIX D:

TECHNOLOGY PROFICIENCY SELF-

ASSESSMENT FOR 21ST CENTURY LEARNING

Technology Proficiency Self-Assessment for 21st Century Learning (TPSA C21)

I feel confident that I could...

	SD	D	U	A	SA
1. ...send e-mail to a friend.	1	2	3	4	5
2....subscribe to a discussion list.	1	2	3	4	5
3. ...create a distribution list" to send e-mail to several people at once.	1	2	3	4	5
4....send a document as an attachment to an e-mail message.	1	2	3	4	5
5....keep copies of outgoing messages that I send to others.	1	2	3	4	5
6. ...use an Internet search engine (e.g., Google) to find Web pages related to my subject matter interests.	1	2	3	4	5
7. ...search for and find the Smithsonian Institution Web site.	1	2	3	4	5
8. ...create my own web page.	1	2	3	4	5
9. ...keep track of Web sites I have visited so that I can return to them later. (An example is using bookmarks.)	1	2	3	4	5
10. ...find primary sources of information on the Internet that I can use in my teaching.	1	2	3	4	5
11. ...use a spreadsheet to create a bar graph of the proportions of the different colors of M&Ms in a bag.	1	2	3	4	5
12. ...create a newsletter with graphics.	1	2	3	4	5
13. ...save documents in formats so that others can read them if they have different word processing programs (eg., saving Word, pdf, RTF, or text).	1	2	3	4	5
14. …use the computer to create a slideshow presentation.	1	2	3	4	5
15. ...create a database of information about important authors in a subject matter field.	1	2	3	4	5
16. …write an essay describing how I would use technology in my classroom.	1	2	3	4	5
17. ...create a lesson or unit that incorporates subject matter software as an integral part.	1	2	3	4	5
18. ...use technology to collaborate with teachers or students, who are distant from my classroom.	1	2	3	4	5
19. … describe 5 software programs or apps that I would use in my teaching.	1	2	3	4	5
20. ...write a plan with a budget to buy technology for my classroom.	1	2	3	4	5

21. …integrate mobile technologies into my curriculum.	1	2	3	4	5
22. …use social media tools for instruction in the classroom. (ex. Facebook, Twitter, etc.)	1	2	3	4	5
23. …create a wiki or blog to have my students collaborate.	1	2	3	4	5
24. …use online tools to teach my students from a distance.	1	2	3	4	5
25. …teach in a one-to-one environment in which the students have their own device.	1	2	3	4	5
26. …find a way to use a smartphone in my classroom for student responses.	1	2	3	4	5
27. … use mobile devices to connect to others for my professional development.	1	2	3	4	5
28. … use mobile devices to have my students access learning activities.	1	2	3	4	5
29. … download and listen to podcasts/audio books.	1	2	3	4	5
30. … download and read e-books.	1	2	3	4	5
31. … download and view streaming movies/video clips.	1	2	3	4	5
32. … send and receive text messages.	1	2	3	4	5
33. … transfer photos or other data via a smartphone.	1	2	3	4	5
34. … save and retrieve files in a cloud-based environment.	1	2	3	4	5

Adapted by R. Christensen & G. Knezek based on the TPSA created by and used with permission of Dr. Margaret Merlyn Ropp.
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APPENDIX E:

TEACHER INTERVIEW GUIDE

Personal Information

1. How long have you been an early-childhood teacher?

2. Have you worked with other ages, if so what other ages?

3. How long have you worked in this district?

Technology Usage

4. What technology do you use in your classroom for instruction?

5. Tell me about the technology the children use in your classroom.

6. How do you decide what educational technology to use in your classroom?

7. What strategies have you found to be helpful when selecting educational technology in your classroom?

8. Tell me about the training you have received on implementing education technology into your early-childhood classroom.

9. How would you describe your beliefs about technology use in the early-childhood classroom?

Developmentally Appropriate Practices (DAP)

10. What does developmentally appropriate practice mean to you?

11. Do you use DAP in deciding what educational technology is appropriate to use in your classroom?

12. How do you decide if the technology you are using in your classroom is developmentally appropriate?

13. What suggestions would you give other teachers for implementing change toward using developmentally appropriate educational technology?

14. Do you think you would benefit from professional development on how to implement developmentally appropriate educational technology in an early-childhood classroom?

15. If so…tell me what that would look like to you