2019

Exploration of K-5 Teacher Decision-Making Related to Student Use of Technology

Eric Noel Rodriguez
Walden University

Walden University

College of Education

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Eric N. Rodríguez

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Dr. Darci J. Harland, Committee Chairperson, Education Faculty
Dr. Christopher Rasmussen, Committee Member, Education Faculty
Dr. Paula Dawidowicz, University Reviewer, Education Faculty

The Office of the Provost

Walden University
2019

Abstract

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MA, Walden University, 2011

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Dissertation Submitted in Partial Fulfillment

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Abstract

Student technology literacy is critical for success in today's world; however, little is understood about how teachers make the decision for students to use technology for learning due to limited empirical research on the topic of teacher decision-making regarding student use of information communication technologies (ICT). The purpose of this generic qualitative study was to explore the decision-making process of kindergarten to Grade 5 (K-5) teachers regarding implementation of ICT for student use at varying levels. The framework for this study comprised the substitution augmentation modification redefinition model and the technology acceptance model. The research questions focused on how teachers have students use technology in the classroom, the influences on teacher decision-making to have students use technology, and how decision-making compared among K-5 teachers whose students use technology at varying levels of implementation. Interview data were collected from 12 teachers at a public-school district in the southern United States that were analyzed using 2 cycles of coding: a priori and emergent. Key findings were that (a) teachers have students use technology primarily at substitution and augmentation levels, (b) teacher decisions were influenced mostly by student technology readiness, and (c) teachers who used technology at redefinition levels had different factors for decision-making. The results of this study may contribute to positive social change by creating a deeper understanding of the decision-making process of teachers, which can positively affect student engagement, academic growth, and lay the foundations for technology literacy for students.

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Dedication

Soli Deo gloria!

Acknowledgments

To my loving wife, Maritza: I know you anticipated beginning this process before me, but now I can repay your support and sacrifice in kind as you embark upon your doctoral journey. I feel unworthy of your love, but please accept my life-long devotion to you as recompense for the inequity. To my son, Ethan, I have come to realize that everything I have done in my life does not give me as much pride, fulfillment, or joy as being your dad. I will spend the rest of my days working tirelessly to help prepare a foundation from which you can build your life, find your passion, and recognize your purpose. I can never adequately express the depths of my gratitude to my parents who taught me the value of education, and hard work. I am proud beyond measure to be your son. I am constantly inspired by my sister, Jamie Rene, and my nephew, Jaxon, to persist in life and see the goals you set for yourself through to completion with grace and confidence; I always want you to be proud of me. Thanks to my friend, Jamie Locklin, who without his support could not have moved forward to pursue this degree, and who conditioned me to be patient and receptive in the face of criticism for the sake of quality and perfection. Thank you to my team for your invaluable support and willingness to listen to me drone on about this process, I hope one day I can repay the favor. To my dissertation committee: Dr. Harland, thank you for being the mentor that I needed in order to finish, and for being the teacher that I one day hope to become. Never once did I feel overwhelmed thanks to your calm, patient, and steadfast reassurances. To Drs. Rasmussen, Dawidowicz, and all Walden faculty, thank you for imparting not only your own understanding, but a piece of your heart into all you do for your students.

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Chapter 1: Introduction to the Study

Introduction

Decision-making in education is a process relatively unexplored, although critical in the overall equation of student success and development. Danielson (1996) provided evidence that teachers make, on average, over 3,000 nontrivial decisions in one class day. At least one of those nontrivial decisions is whether to have students use information communication technologies (ICT) in a lesson. For the purposes of this study, ICT was defined as: devices, such as a smartphone, computer, or a tablet, that have a wireless Internet connection, including computer software applications, which allow for reciprocal communication (Biddix, Chung, & Park, 2016; Sánchez, Marcos, González, & GuanLin, 2012). In this study, I examined the phenomenon of kindergarten-Grade 5 (K-5) teacher decision-making regarding student use of ICT.

Students' use of ICT has shown to be important to the kinds of skills that employers desire. For instance, commonly requested skills desired by U.S. business executives were problem-solving, collaboration and teamwork, and communication (McCarthy, 2017; Williams, 2019). The International Society for Technology in Education (ISTE; 2018) published *Student Standards* for educational stakeholders to have a foundation to build and integrate digital literacy into curriculum in schools; these standards were also designed to support students in achieving growth and mastery in the areas most desired by those who might potentially be their future supervisors. The implications of student digital literacy are far reaching for every student in all grade levels and content areas. I conducted this study so that teacher decision-making,

specifically to use ICT, and impact on potential growth in digital literacy for every student can be better understood. Understanding teachers' decision-making process may provide insight to stakeholders for how to support teachers and students in the future. Subsequent sections of this chapter include the background for this study, highlighting some of the literature found to support the gap and necessity for further research on this topic. In addition, Chapter 1 includes the problem statement, purpose of the study, research questions, conceptual framework, nature of the study, definitions, assumptions, scope and delimitations, limitations, and significance.

Background

In my review of the literature related to appropriate technology literacy skills for K-5 students, K-5 teachers' decision-making for students using ICT, and how teachers have students use ICT, I attempted to determine what empirical research has been conducted. The results of my exhaustive search for empirical evidence led me to conclude that the majority of research that exists pertaining to these topics has been conducted at the secondary and higher education levels. Little research has been done on elementary-level literacy skills, teacher decision-making, or how students use educational technology for learning.

For instance, research related to ISTE student standards for appropriate technology literacy, including digital citizenship, knowledge construction, innovative designer, computational thinker, creative communicator, and global collaborator, does not exist to a large extent within an elementary setting in empirical research. The research on technology literacy has primarily focused on secondary, higher education, and

preservice educators. Although there is a multitude of research on technology tool integration at the K-5 level with iPads (Nepo, 2017; Rivera, Hudson, Weiss, & Zambone, 2017; Stavridi, 2015); laptops (Martin & Carr, 2015; Rabah, 2015); and software (Chu, Angello, Saenz, & Quek, 2017; Sáez-López, Román-González, & Vázquez-Cano, 2016; Ural & Ercan, 2015), there is little research on building K-5 digital literacy skills. Current K-5 research does not often frame studies using the ISTE standards. K-5 technology literacy research, even using various synonyms for the language used in the ISTE standards, is lacking. Of the technology literacy skills, *empowered learner* had the most research, and *digital citizen* had the least. These gaps in the K-5 technology literacy research may be an indication of several phenomena.

First, this gap may indicate that educational stakeholders and researchers are still in the early stages of awareness of the importance in providing students with knowledge about what it means to be a good digital citizen. The effects of decision-making online have grave consequences. The lack of K-5 research related to technology literacy might also mean that teachers perceive these skills as being separate from core content and spending time teaching them will detract from their ability to teach curriculum even though technology literacy skills are linked and opportunities to teach content alongside technology literacy skills is possible. Addressing this gap is important because the growing trend in society is to require proficiency in ICT use; therefore, technology literacy is critical for future student success and career preparedness. Consequently, in this study I explored the K-5 teacher decision-making process related to implementing student use of technology. Data from this study may contribute to what is understood

related to how teachers have K-5 students use technology and the teacher decision-making process that accompanies that use.

Secondly, when examining K-5 teacher decision-making to have students use ICT, again I found a similar state of research with not much empirical evidence gathered concerning the topic of K-5 teacher decision-making. In contrast, there is a greater number of studies that focus on secondary teacher perception where time was a significant factor (Ghavifekr, & Rosdy, 2015; Kaleli-Yilmaz, 2015; Tallvid, 2016). Whether the factor is outcome expectancy, task-technology fit (TTF), social influences, or personal, each has an empirical bearing on a K-5 teacher who is deciding to choose if they want their students to use ICT. These were critical factors that helped to inform my study as I sought to better understand the decision-making process of K-5 teachers who choose to have their students use ICT.

Lastly, after searching for literature related to how elementary teachers have their students use ICT, I arrived at a similar result. A majority of the empirical research pertaining to actual student use of ICT was found in the secondary and higher educational settings, such as high schools and universities. Throughout my searches I used ranges from simple ICT use at the substitution level of Puentedura's (2013) substitution, augmentation, modification, redefinition (SAMR) model, which help to describe levels of technology use, such as students using computers and interactive white boards for writing and spelling practice (McDermott & Gormley, 2016) to the highest level of the SAMR model, redefinition, where students learn in augmented reality (AR) and virtual reality (VR) using iPads and VR goggles (Anderson, Smith, Corbat, Minshew, &

Madlangbayan, 2016; Furió, Juan, Seguí, & Vivó, 2015). While there is much literature on how elementary teachers use technology for instruction (e.g., Alakärppä, Jaakkola, Väyrynen, & Häkkilä, 2017; Tay, Lim, & Lim, 2015; Uluyol & Şahin, 2016), there are fewer empirical research studies examining how elementary students use technology in the learning process. Within these studies, most examples describe students using technology at the substitution and augmentation levels of the SAMR model (Alkash & Al-Dersi, 2017; Huang, Su, Yang, & Liou, 2017; Zhang, Trussell, Gallegos, & Asam, 2015). There are a few studies that highlight how students are using technology at the modification or redefinition (Cherner & Smith, 2017; Puentedura, 2013) levels of the SAMR model. Since teachers usually move through the lower levels of the SAMR model before moving to higher levels (Colwell & Hutchison, 2015; Falloon, 2015; Morgan, 2015), it is logical that there are more studies about student experiences in the lower levels of technology use. What is not understood is the teacher perspective of this process or what enables or hinders them to have students use technology at various stages of technology integration, which is why this study was needed.

Problem Statement

Today's students entering universities and career fields need to be equipped with the skills to use technology that will support their success as they leave the K-12 environment. Educational stakeholders who seek to support teachers in providing experiences so that students are technology literate should avail themselves of the latest research in understanding how to augment support for teachers as they design lessons incorporating skills for the demands of today's learning (Teo, Fan, & Du, 2015). When

students actively use ICT for educational purposes, researchers have indicated a significant positive relationship between use and academic achievement (Ekici & Pekmezci, 2015; Laronde, MacLeod, Frost, & Waller, 2017; Mango, 2015; O'Bannon, Waters, Cady, Rearden, & Lubke, 2017; Savage & Brown, 2014; Sahlin, Tsertsidis, & Islam, 2017). However, when a teacher decides to provide educational technology to his or her students to use for the creation or demonstration of mastery, they do so based on a number of factors including past professional experiences and pedagogical beliefs (Bell-O'Leary, 2014; Carver, 2016; Vongkulluksn, Xie, & Bowman, 2018). Research has also shown that teachers' perceptions of how beneficial the technology is affects their decision to use technology (Carver, 2016; Spaulding, 2013). Research on teacher use of ICT has been conducted at the secondary (Ekici & Pekmezci, 2015), postsecondary (Biddix et al., 2016), and preservice levels (Apeanti, 2016; Chiu, & Churchill, 2016), but little research has been conducted at the elementary level. Additionally, little research exists related to why teachers do or do not integrate different individual forms of communication technology (Letwinsky, 2017). In a quantitative study of secondary mathematics teachers, Letwinsky (2017) found a significant relationship between attitudes toward using technology for communication and personal self-efficacy but that teachers still did not implement ICT. What is still not understood is why teachers who seem to have the capacity to use ICT are not taking advantage of the potential that ICT provides (Letwinsky, 2017). The problem related to this study was: that while technology literacy is a key skill needed for student success in today's world, little is understood about the

decision-making process of K-5 teachers as it relates to student use of ICT at varying levels of implementation.

Current research indicates that this problem is relevant to the field of educational technology. Teachers' pedagogical beliefs impact their decision-making processes related to when and if they decide to use ICT (Ertmer, 2005; Tondeur, vanBraak, Ertmer, & Ottenbreit-Leftwich, 2016). The role technology has in a teacher's classroom relates to what teachers believe about learning and instruction and is why the decisions teachers make should be explored. Furthermore, other studies have provided evidence of how teachers have K-5 students use technology in the classroom in the context of Puentedura's (2006) SAMR model (Amr, Al-Natour, Al-Abdallat, & Alkhamra, 2016; Aubusson, Burke, Schuck, Kearney, & Frischknecht, 2014; Bartha, Dombai, Egan, & Hengst, 2016; Share, 2015; Ylizarde & Shockley, 2018). Yet, there is a notable absence of empirical evidence that addresses teacher decision-making in the context of student use under the lens of SAMR model, or otherwise, in a K-5 classroom context. When stakeholders have a greater understanding of teacher decision-making, they may be able to provide better support in the process of technology integration, especially during the formative years of education where students will benefit from a solid foundation of technology literacy. A better understanding of early primary (i.e., K-5) teacher decision-making is critical to educational technology because students' early technology exposure and use increases their digital literacy, which is an important life skill (Hsu, Wenting, & Hughes, 2018). I could not find a qualitative examination focused on elementary school teachers in K-5 in the literature. And last, the problem is meaningful because even when

ICT resources and ICT professional development are available to K-5 teachers, it is not known how this population of teachers determines whether and how to use technology with students.

Purpose of the Study

The purpose of this generic qualitative study was to explore the decision-making process of K-5 teachers regarding implementation of ICT for student use at varying levels. To accomplish that purpose, I explored how teachers implemented ICT with K-5 students and the decision-making process that supported that implementation decision. The SAMR model describes ICT use in four categories: substitution, augmentation, modification, and redefinition (Puentedura, 2006), which help to define the levels of technology use by students. I used the SAMR model to describe how teachers have students use ICT. The TAM (Davis, 1989) is a theoretical model used to describe the technology acceptance process. In this study, I used the TAM to help describe teacher decisions for implementing student use of technology the way they have. Addressing this gap in the research will lead to a better understanding of what influences the decisions of how teachers implement ICT with students, which will positively affect engagement and academic growth and may help to lay the foundations for technology literacy.

Research Questions

Central Research Question: How do K-5 teachers describe their decision-making process to implement student use of ICT?

Related Research Questions

1: How do K-5 teachers have students use ICT in the classroom?

2: What influences teacher decisions to have student use technology?

3: How does the decision-making process compare among K-5 teachers who use technology with students at varying levels of implementation?

Conceptual Framework

The conceptual framework that informed the research design of this study was based on the SAMR model by Puentedura (2013) and the TAM by Gu, Zhu, and Guo (2013). The decision-making of K-5 teachers behind having students use ICT was the phenomenon that I analyzed through the lens of the SAMR and TAM models. The first model, SAMR, is a four-level, taxonomy-based approach for selecting, using, and evaluating technology implementation in K-12 settings (Puentedura, 2013). The SAMR model is used to categorize ICT use and informed my study based on how teachers describe their implementation and how student use ICT. The SAMR model was also used to purposefully sample teachers and develop data collection and analysis tools for interview questions. The second model, TAM, includes four constructs of technology use: outcome, TTF, social influence, and personal interaction (Gu et al., 2013). I used the TAM to develop my interview questions to better understand the decision-making process that teachers use in whether and how to have students use technology. The constructs of the SAMR model and TAM were also used for a priori coding during data analysis. I used the SAMR model to answer research question 1, the TAM model to address research question 2, and both to answer research question 3. A more detailed description of both the SAMR and TAM models will be provided in Chapter 2.

Nature of the Study

In this qualitative study, I applied the generic qualitative inquiry methodology to explore the decision-making process of elementary K-5 teachers to have students use ICT. According to Percy, Kostere, and Kostere (2015), generic qualitative inquiry can be defined as research that investigates people's accounts of their own opinions, attitudes, beliefs, or reflections in their experiences of events in the world. Percy et al. recommended that generic qualitative inquiry be used when the research problem requires a qualitative methodology, when other qualitative approaches are inappropriate, and when the researcher has prior knowledge about the topic that he or she wants to describe more fully from the perspective of the participant. My study fit the description provided by Percy et al., and a generic qualitative inquiry was the most appropriate choice for this study because the research questions are focused on exploring teacher decision-making, which includes their subjective opinions, attitudes, and beliefs of their experiences. Percy et al. recommended that data collection for generic qualitative study include several sources, such as interviews, questionnaires, and written or oral surveys to answer the research questions (p. 79).

The subject of inquiry for my study was the process that K-5 teachers undergo as they make the decision to use ICT in the lessons they design for student use. Participants included 12 K-5 teachers who were employed within a school district located in the South-Central United States. As recommended by Merriam (2001), I used purposeful sampling to include teachers implementing ICT at various levels with students, specified by Puentedura's (2013) SAMR model. Data were collected from two rounds of

semistructured, individual participant interviews. Data were coded and categorized to determine emergent themes using the lens of the TAM by Gu et al. (2013). I will provide a more thorough explanation of the nature of the study in Chapter 3.

Definitions

Educational technology: Combinations of hardware and software (e.g., iPads, interactive white boards, tablets, computers, smart devices, laptops, and web-based software programs) integrated with teaching and learning (Bednar & Sweeder, 2005; Holden & Rada, 2011).

Information communication technology (ICT): Devices, such as a smartphone, computer, or a tablet, that have a wireless Internet connection, including computer software applications, which allow for reciprocal communication (Biddix et al., 2016; Sánchez et al., 2012).

Substitution, augmentation, modification, redefinition (SAMR) model: A model that describes ICT use in four categories: substitution, augmentation, modification, and redefinition (Puentedura, 2006).

Technology acceptance model (TAM): A theoretical model used to describe the technology acceptance process used to help describe teacher decisions for implementing use of technology (Davis, 1989; Gu et al., 2013).

Technology literacy: "The ability of individuals to use ICT appropriately to access, manage, integrate and evaluate information, develop new understandings, and communicate with others in order to participate effectively in society" (ISTE, 2018, p. 60).

Assumptions

This study was based on several assumptions. The first assumption was that the volunteer participants would disclose their demographic information correctly and accurately. This assumption was important because it provides credibility to the study in the form of accuracy related to the experiences of the teachers within the study. I also assumed that participants would be able to accurately depict their perceptions, both past and present, related to their decision-making process of having students use ICT and how students use ICT. This assumption was important because the accuracy and reliability of the study was built on the teachers' accurate recounting of their perceptions as they make the decisions for their students to use ICT in the classroom.

Scope and Delimitations

The scope of this study was based on certain boundaries. It was first bound by topic. In this study, I did not focus on the challenges or barriers of educational technology integration or the professional development or effectiveness of professional development related to technology integration in education. This study was not focused on the attitudes, perceptions, or motivations of teachers toward ICT, rather; it was focused on decision-making and some of the factors that may impact those decisions. This study did not address the effectiveness of educational technology on a students' educational achievement; although, there are mentions of the benefits that are possible when ICT is used. Furthermore, this study was bound by the purpose, which was to explore the decision-making process of K-5 teachers regarding implementation of ICT for student use.

The delimitations of this study involved the selection of participants, resources, and time. This study was focused on the decision-making process of elementary teachers whose students were in Grades K-5. I did not include perceptions of decision-making from secondary or higher education teachers or students. Teachers had to possess or have access to educational technology for their students to use in order to participate in this study. Teachers who did not have technology or access to educational technology could not participate. The study was narrowed even further due to limits of resources and time as a single researcher. I am a student with limited financial resources and not a full-time researcher. At the time of the study, I was a full-time educator working in a public-school district; therefore, I was not able to devote the majority of a week day to research.

Limitations

The research design of a study often creates limitations. Merriam and Tisdell (2016); Patton (2015); and Caelli, Ray, and Mill (2003) described some potential limitations due to using the generic qualitative research design. For instance, Merriam and Tisdell warned about researcher bias linked to the omission of data or inaccurate data interpretation due to professional experience as a practitioner. Data generated from the study may not be consistent with a researcher's experience. The potential for this form of bias was relevant in this study due to my professional role as a digital learning coach and previous experience as a fourth and fifth grade teacher whose students used educational technology in class. In Chapter 3, I acknowledge potential bias and propose strategies were used to mitigate this potential bias and strengthen the trustworthiness of this study, such as member checking. Another limitation was that I was the sole researcher with

limited time and resources. The limitations created by time and finite resources were addressed and mitigated by triangulation. Finally, Caelli et al. cautioned against "a lack of methodological clarity" and suggested the researcher be deliberate and intentional about articulating issues that arise when using a generic qualitative research design (p. 6). I followed this suggestion throughout the course of this study.

Significance

The significance of this study is determined in relation to (a) advancing knowledge in the field of educational technology, (b) improving professional practice, and (c) contributing to positive social change. In relation to advancing knowledge, researchers and educators may be provided with increased understanding of the decision-making process of teachers who choose to use ICT for students through the focused interviews and observations in this study. In relation to improving practice, the results of this study may lead to stakeholders, such as central administrators, campus administrators, instructional coordinators, and coaches, better understanding the factors that influence teacher technology implementation decisions, so districts can foster environments in which teachers are more likely to implement technology with young students. This study may also reveal factors that the district does not have control over, in which case adjustments of resource allocation may be called for. In relation to contributing to positive social change, this study may affect change by creating a deeper understanding of the decision-making process of teachers, which will positively affect student engagement and academic growth as well as lay the foundations for technology literacy.

Summary

In this chapter, I described the background of this study, including a brief summary of the current empirical research related to this study. The problem statement and purpose of the study were discussed to provide a focus on the need for increased understanding of the decision-making of teachers in K-5 classrooms as they decide whether their students use ICT for learning and how. The research questions were provided to frame the scope of this study along with the conceptual framework comprising the SAMR model and TAM as analytic lenses. The section on the nature of the study included a brief description of the methodology, the generic qualitative research method, that was used in this study. Definitions were provided to clarify the key terms most significant for this study. I then provided the scope, delimitations, and limitations to establish the boundaries for this research study. Finally, Chapter 1 concluded with a description of the significance of the study. In Chapter 2, I will provide a description of the literature search strategy for the literature review, discuss the conceptual framework for this study, and present a comprehensive review of the current empirical research related to the key concepts of this study.

Chapter 2: Literature Review

Introduction

The problem addressed in this study was that while technology literacy is a key skill needed for student success in today's world, little is understood about the decision-making process of K-5 teachers as it relates to student use of ICT. The purpose of this qualitative study was to explore the decision-making process of K-5 teachers regarding the implementation of ICT for student use at varying levels. For instance, elementary teacher decision-making might be influenced by the level of technology that students use during their learning experiences. The levels of use are delineated in Puentedura's (2006) SAMR model. The major themes that emerged from an exhaustive review of the literature pertained to the internal and external factors that influence a teacher's decision-making. These factors are well documented and researched in the TAM by Gu et al. (2013). The internal factors are outcome expectancy TTF, and personal factors, and the external factors are social influences, such as environment, and social factors (Gu et al.). Currently, there are few empirical studies with a focus on elementary teacher decision-making concerning students' use of ICT. However, there are many studies that focus on the decision-making and use of ICT based on populations of teachers and students in a secondary and higher education environment.

The phenomenon of elementary teachers' decision-making to have students use ICT is one that deserves attention due to the possible implications for student literacy, academic achievement, and readiness in subsequent grade levels (Ekici & Pekmezci, 2015; Laronde et al., 2017). In addition, teachers' pedagogical beliefs impact their

decision-making processes related to when and if they decide to use ICT (Ertmer, 2005; Tondeur et al., 2016). When teachers make the decision to include ICT in a lesson for students to use, they do so within a process that is based on a number of internal and external factors, including perceptions, experiences, their environment, and social influences (Carver, 2016; Spaulding, 2013). Little research exists on the various reasons teachers choose to have students use ICT (Letwinsky, 2017). The problem related to this study was that little is understood about the decision-making process of K-5 teachers as it related to student use of ICT at various levels.

Chapter 2 includes a description of the literature search strategies, followed by a detailed look at the conceptual framework. Next is the literature review, which includes sections on K-5 teacher technology integration decision-making. This section is followed by appropriate technology literacy skills for K-5 students, and finally, how elementary teachers have their students use technology.

Literature Search Strategy

I primarily obtained the sources used in this literature review from peer-reviewed journals and practitioner journals. The search process for discovering applicable resources pertaining to my topic began among the texts utilized throughout the dissertation program authored by authorities in the field of educational technology and theory. In addition, I made note of potential journal articles that could be used later throughout my coursework. During the prospectus and literature review phases, searches of ProQuest, Education Source, ERIC, Sage Journals, Science Direct, Academic Search Complete, Google Scholar, Computers and Applied Science Complete and Emerald

Insight databases were conducted through the Walden University online library. The search for literature continued with searches in the title or abstract using keywords, such as *digital citizenship, empowered learning, teacher decision-making, information communication technology student use, digital literacy skills, elementary or primary use of ICT,* and *teacher perception of ICT use.* See Table 1. All resources were organized and categorized in a literature review matrix in a Microsoft Excel spreadsheet.

In my search for empirical research articles for K-5 teacher decision-making and student use of technology, I found that there were scarce resources on these topics. In order to supplement the current gap in literature, practitioner journals were also reviewed and included for their examples of how teachers include the use of technology in classrooms for students. Despite not being peer reviewed, these articles were included because they provided anecdotal evidence of teachers sharing how they have students use ICT. Their inclusion was justified because it showed that although little empirical research has been done showing teachers implementing ICT at various levels within the SAMR model, the phenomenon is occurring.

Table 1

Literature Review Search Terms

Topic of Research	Key Terms	Subject Terms
Elementary classrooms	Elementary, primary, K-5	Elementary education, primary education, school children, elementary schools
Appropriate technology literacy skills for K-5 students	Emergent, beginning, Foundational literacy, Computer skills, Online, Digital citizenship, Empowered learner	Computer literacy, online safety, privacy, netiquette
Technology integration decision-making	Using technology, barriers, benefits, thought process, factors, Decision-making constructs, personal, teacher decision-making, environmental, motivations	technology use, benefits and barriers, TTF, technology outcome, personal factor, environmental factor
How teachers have their students use technology	Collaboration, communication, design, create, enhancement, transformation, substitution, augmentation, modification, redefinition, devices, tablet, smartphones, computer, word processing, Google apps, software, mobile devices, Smart board	Authentic learning, authentic purpose, task redefinition, SAMR model

Conceptual Framework

The conceptual framework used in this study included two models: the SAMR model by Puentedura (2013) and the TAM created by Gu et al. (2013). Together these models helped to focus the analysis on the decision-making of K-5 teachers who choose to have their students use ICT. I used the SAMR model to explore the phenomenon of technology implementation and how teachers described their students' use of ICT, either for enhancement or transformation. The TAM was used to explore the phenomenon of teacher decision-making within the constructs of outcome expectancy TTF, social influence, and personal factors.

Substitution, Augmentation, Modification, Redefinition (SAMR) Model

SAMR is a model that represents levels of ICT application (Puentedura, 2006). The taxonomy is divided into two levels, enhancement and transformation, which are then subdivided into four separate categories: substitution, augmentation, modification, and redefinition (Puentedura, 2006). According to Puentedura, the SAMR model was intended to be a tool through which K-12 teachers' use of classroom technology could be described and categorized. The taxonomy was designed to illustrate how technology can either enhance or transform the learning experience of a student when used with various levels of application combined with a task (Puentedura, 2006). The model provides a way for teachers to design tasks for students that move from lower to higher levels of teaching with technology, which according to Puentedura, leads to higher levels of teaching and learning. The SAMR model has been used by many scholars and practitioners for various reasons, such as to evaluate technology use with considerations for the level of student

thought (Cherner & Smith, 2017), to evaluate the use of students' mobile technology (Kadry & Ghazal, 2019), and in creating other models for teachers to assess how digitally-enriched learning and teaching is moving beyond what can be taught using analog technologies (Carrington, 2016). When teachers implement technology, they may start students at the substitution level but later design tasks that can be enhanced and eventually transformed as tasks ascend throughout the levels of the SAMR model.

Puentedura's (2013) SAMR model may have been created based on the researcher's experience managing multimedia labs and technology at Harvard University and presenting for a consulting company. Little is known about the development of the model, and it has not been through large-scale validation and validity testing. Instead, it appears that the SAMR model was developed to help stakeholders in education examine the levels at which they and students are using ICT (Hamilton, Rosenberg, & Akcaoglu, 2016). Despite the lack of information surrounding the development and validity of the SAMR model, its application is still useful in educational settings (Green, 2014). There are several empirical research studies that have used the SAMR model, which range from the adoption of ICT in higher education among students and faculty (Cavanaugh, Hargis, Kamali, & Soto, 2013; Jude, Kajura, & Birevu, 2014); evaluation the ICT competencies of preservice teachers (Khoza, Zlotnikova, Bada, & Kalegele, 2016); evaluation of ICT use in Canadian, English-language high schools (Rabah, 2015); reflection on ICT integration in middle school social studies classrooms (Hilton, 2016); to research on ICT integration into classrooms with students with special needs (Hartmann & Weismer, 2016). The SAMR model helps determine the potential of ICT integration, impact on

teaching and learning, and overall implementation (Jacobs-Israel & Moorefield-Lang, 2013). The SAMR model was suitable for this study because it provided a sound construct for categorizing how teachers implement ICT with students.

Enhancement. The entry level of the SAMR model is called enhancement and is subdivided into two categories: substitution and augmentation (Puentedura, 2013). Substitution is defined as technology acting as a direct substitute for another tool, with little to no functional change (Cherner & Smith, 2017; Kadry & Ghazal, 2019; Puentedura, 2013). Puentedura (2013) provided an example of substitution by describing that an online textbook would be used in place of a school, paper, textbook. In early stages of ICT implementation, a teacher may be interested in students using a tablet to write an essay instead of using paper and pencil or using a digital whiteboard application and stylus on a smart device. The task, which includes ICT, has no functional change; the student could accomplish the task without ICT. Examples provided in research are of students using podcasts to listen to lectures in higher education (Kadry & Ghazal, 2019) and students reading a historical novel as an eBook instead of a paper-based copy (Cherner & Smith, 2017).

While still in the enhancement level of the SAMR model, the augmentation level is defined as technology that acts as a direct tool substitute, with functional improvement (Cherner & Smith, 2017; Kadry & Ghazal, 2019; Puentedura, 2013). The example Puentedura (2013) provided for this level is interactive textbooks where students can click and access additional information on subjects they read about. In other research, examples of augmentation are conducting digital searches for resources in an online card

catalogue (Cherner & Smith, 2017) or students using mobile device phone applications for learning (Kadry & Ghazal, 2019). Other examples of tasks at the augmentation level might require a student to use a tablet to access online graphics or design tables or figures and use these to illustrate an essay they have researched and written. All of these tasks can be done with paper and pen but would take significantly more time. ICT at the augmentation level has provided for a functional improvement to the task.

Transformation. The higher level of the SAMR model is called transformation and is subdivided into two categories: modification and redefinition. This category is different from the enhancement level because it allows for the learning task to be partially or completely changed (Puentedura, 2013). The modification level is defined as technology that allows for a significant task redesign (Cherner & Smith, 2017; Kadry & Ghazal, 2019; Puentedura, 2013). Puentedura's (2013) example of modification involves the analysis of data: Computer software can assist in the creation and suggestion of meta-analysis and aggregation of data from multiple sources inside a collaborative platform where several people have access at once. An example of the modification level in other research using the SAMR model is writing a paper with embedded images, hyperlinks, and video in the body of the paper (Cherner & Smith, 2017). For example, a teacher seeking to modify the task of writing an essay could choose for students to author it using Google Docs and Google Drive and sharing it with another student so they can work together collaboratively. The task of writing an essay is no longer bound by the traditional restrictions, such as distance; although, students can still work on one project collaboratively, the use of Google Docs allows students to work in separate locations.

The highest level of the SAMR model is redefinition, defined as technology that allows for the creation of new tasks that could not have been done without the use of technology (Cherner & Smith, 2017; Puentedura, 2013). The example Puentedura (2013) provided was the opportunity to create and edit a multimedia presentation using sound, graphics, animation, and text together to demonstrate understanding. Teachers implementing ICT at this level of the SAMR model are able to redefine a task that was not previously possible. For example, students can create an e-book using the iOS software iBooks Author; design a digital book using the essays and other media created by students, co-author it with students in another county and publish it for free to make it available to anyone in the world. Examples of redefinition in other research is presenting research in a narrated multimedia slideshow where the text and voice over are synchronous (Cherner & Smith, 2017), and using smart phone application-based materials for students to engage with and learn from (Kadry & Ghazal, 2019).

The SAMR model was applied in this study to categorize the ICT tasks teachers say they have students do in K-5 classrooms. Based on interviews from teachers in elementary classrooms, the learning tasks teachers give students along with the ICT that students are asked to use were categorized into one of the SAMR model levels. In combination with the TAM, the SAMR model provided a way to explore decision making patterns that existed among teachers who implement student use of ICT at certain levels of the SAMR model.

Technology Acceptance Model (TAM)

The first element of the conceptual framework for this study is the TAM. The TAM has a history of almost 30 years and has several iterations since it was first proposed in the late 80s. Ajzen (1991) proposed the theory of planned behavior, as a variation of the theory of reasoned action (Fishbein, 1980). In this model, a person's behavioral intention is hypothesized to be the most effective predictor of behavior (Ajzen, 1991). Behavioral intention is influenced by attitudes towards the behavior, subjective norm, and perceived behavioral control. Based on the theory of reasoned action, Davis (1989) proposed the TAM to assess users' technology acceptance for different technological tools (Chow, Herold, Choo, & Chan, 2012; Evans et al., 2014; Venkatesh & Davis, 2000; Wallace & Sheetz, 2014), across gender (Teo et al., 2015), length of service, teaching level (Teo et al., 2015), and cultures (Teo, Ursavas, & Bahçekapili, 2012). According to Teo and Zhou (2014), TAM compared with other models such as the and theory of planned behavior, was more powerful in predicting behavioral intention. In studies, meta-analysis of the TAM showed that it was been successful in predicting about 40% of ICT use. Due to the ease of application and effectiveness for predicting use and explaining acceptance of ICT many other theoretical models incorporate some of all the constructs in the TAM in pursuit of determining acceptance. Gu et al. (2013) posited that a variety of theoretical models attempt to explain the factors that determine individual acceptance of ICT, however, little attention has been paid to ICT acceptance in the classroom. Furthermore, Gu et al. wrote that the potential impact of technology depends on both the teacher and the students who use it. The TAM

written by Gu et al. was designed to focus on technology acceptance within an educational setting, the only such model to do this. This version of the TAM is a variation of the model written by Davis (1989) and differs based on the additional constructs included such as TTF and social influences. The Davis model does not account for these factors which impact, and can ultimately be used to predict and understand, ICT use, particularly in the classroom. Also, of note in the Davis model, constructs are linear and have a causal relationship which is not the case for the Gu et al. model; each construct is independent and has its own bearing on ICT adoption and use.

Outcome expectancy. Among all four constructs of the TAM, outcome expectancy has also been referred and researched using the terms perceived usefulness, relative advantage, or performance expectancy, and has been found to be among the best way to anticipate a person's use of ICT. The construct of outcome expectancy is widely held as the most important predictor of technology use and has been verified as such by empirical methods of analysis (El-Gayar, Moran, & Hawkes, 2011; Venkatesh, Morris, Davis, & Davis, 2003). According to Venkatesh et al. (2003), outcome expectancy can be defined as, "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (p. 447). Gu et al. (2013) defined outcome expectancy as "a person's beliefs and attitudes on the use of ICT" (p. 394). In education this may translate into a teacher's anticipation of how ICT will enhance the learning experiences for students, make access to educational resources more ubiquitous, and the learning process more equitable.

Task-technology fit. The second construct of TAM is TTF. According to Gu et al. (2013), a teacher's decision to use ICT may be influenced by TTF defined as, "the degree to which a technology assists an individual in performing his or her task" (p. 394). This construct has been addressed as effort expectancy in other technology acceptance literature. A task will fit with the ICT application when the application meets the requirements that result in a positive impact on a person's performance (Gu et al., 2013). The assumption made within the TTF construct is that a person will accept ICT due to the potential benefits, such as increase in performance. In education, and specifically in this study, the TTF construct was explored in terms of how teachers perceive technology improving students' ability to accomplish age-appropriate tasks.

Social influence. The effects of social influence on the decision-making process to use ICT is another statistically significant factor among the four constructs written by Gu et al. (2013). According to Ajzen (1991), social influence can be defined as the perception of social pressures to perform or not to perform a task. Empirical evidence validates that social influences, such as perceived social pressures from others, are factors that predict ICT use (Lewis, Agarwal, & Sambamurthy, 2003) and positively and significantly affect ICT use (Kim et al., 2014; Thompson, Compeau, & Higgins, 2006). The factor of social influence is an important construct that was taken into account in this study to analyze if and how grade-level, building, district, or other social influences impact the decision-making process of K-5 teachers of whether to have students use ICT. Education is a social profession and accounting for this influence in decision-making for

this study is a critical factor in understanding how teachers decide for their students to use ICT.

Personal factors. The final construct posited in the Gu et al. (2013) version of the TAM is called personal factors, which affect a person's decision to use ICT. Gu et al. determined that personal factors for ICT use were necessary to include in analysis of decision-making. These personal factors include computer self-efficacy and personal innovativeness in working with ICT. Gu et al. define self-efficacy as, "the belief in one's capability to perform a particular behavior" (p. 349). This perception of self-efficacy influences the decision-making about what behaviors to carry out, how much effort is required in the task, and the emotional responses that may result (Gu et al., 2013). Personal factors are recognized as one of the statistically significant constructs that influence a person's use of ICT (Compeau, Higgins, & Huff, 1999; Lewis et al., 2003; Strong, Dishaw, & Bandy, 2006; Thompson et al., 2006). Furthermore, a kind of personal factor taken into consideration in previous studies is personal innovativeness which is the degree an individual is willing to try new ICT (Gu et al., 2013). In education, and in this study, self-efficacy and personal innovativeness are factors that are connected to the quality of teaching. Teachers attend professional development to stay current on the latest and most effective practices. Personal factors are crucial in understanding and predicting ICT use in education. Studying these factors provided insight into which personal factors influence K-5 teachers' decision-making regarding implementation of ICT with students.

Appropriate Technology Literacy Skills for K-5 Students

Technology literacy for students is defined in a multitude of ways. Most researchers are consistent in including considerations for similar terms such as digital competence, computer and information literacy, Internet skills, ICT literacy, media literacy, new media literacy, network literacy, technology fluency, and 21st-century skills (Siddiq, Hatlevik, Olsen, Throndsen, & Scherer, 2016). A synthesized definition written by Siddiq et al. influenced by ISTE student standards states, "the ability of individuals to use ICT appropriately to access, manage, integrate and evaluate information, develop new understandings, and communicate with others in order to participate effectively in society" (p. 60). The ISTE student standards are a framework for students, educators, and administrators that can be used to create innovative learning environments (2018). The standards help educators and leaders understand a more innovative approach to learning. The seven student standards are: empowered learner, digital citizen, knowledge constructor, innovative designer, computational thinker, creative communicator, and global collaborator (ISTE, 2016, p. 1). These standards play an important role in my study because they establish the value of educational technology in the overall educational growth of students and establish a base line for good practices when it comes to integrating educational technology into lessons.

In this study I referenced the ISTE standards and connect previous research to the use of ICT by K-5 students to demonstrate appropriate literacy. The ISTE standards, when used in the classroom setting, are expected to yield the following results: improve higher-order thinking skills, such as problem solving, critical thinking, and creativity,

prepare students for their future in a competitive global job market, design student-centered, project-based, and online learning environments, guide systemic change in our schools to create digital places of learning, and inspire digital age professional models for working, collaborating, and decision making (ISTE, 2007). Based on the definition provided by Siddiq et al. (2016), students having the ability to access, manage, integrate and evaluate information, develop new understandings, and communicate with ICT are technology literate. Appropriate technology literacy skills for K-5 students is illustrated in the context of ISTE standards for students in the following sections.

Empowered Learner

The first ISTE student standard provided to conceptualize appropriate technology literacy is that students are empowered. This student standard is defined as students who "leverage technology to take an active role in choosing, achieving and demonstrating competency in their learning goals, informed by the learning sciences" (ISTE, 2016, p. 1). While ISTE standards aspire teachers to have students use technology to become empowered, there is very little empirical research on how technology aids young elementary students specifically. However, results from research often describe the importance of K-5 students in relation to; (a) having choice, (b) individualized and personalized instruction by differentiation, and (c) in increase of student agency. The Hwang and Lai (2017) study, supports the notion that ICT provides empowerment in learning to students by promoting self-efficacy and choice. Their quasi-experimental study with two fourth grade math classes showed that using an interactive e-book approach in a flipped learning classroom resulted in improve student achievement and

increased confidence. Even though there is not a lot of empirical research on student empowerment pertaining to use of ICT in K-5, teachers do publish their success stories in practitioner journals. For example, Maxwell (2015) published a review of literature using thematic analysis of articles written about K-12 classrooms using one-to-one laptop initiatives to draw the conclusion that when laptops are given to students, they become a tool for learning where students can benefit from a more individualized and differentiated learning environment. Students using ICT, like laptops, in classrooms can lead to increased student empowerment due to a teacher individualizing and differentiating the course content. In a qualitative-descriptive case study on fifth grade elementary students using internet technology and the blended/flipped classroom model, empirical evidence in the form of data from student and teacher interviews were analyzed and indicated active learning and student ownership of learning increased (Mosher, 2016). Students given access to ICT as an integrated piece of an overall model can increase a student's access and accountability to educational progress. In another example, the data generated and analyzed from a pre/post-test, and a questionnaire in a quasi-experimental study in two fourth grade elementary school math courses using ICT in flipped lessons indicated that an increase in students' active learning, ownership, and self-efficacy resulted (Hwang & Lai, 2017). Current research studies on flipped classrooms indicate that student empowerment results when teachers use a mixture of ICT and other traditional approaches. Teachers seeking to empower their students might consider the blended/flipped learning approach where ICT is integrated as a part of the learning

model. Collectively, these studies show that when ICT is used in conjunction with sound pedagogical strategies students may feel empowered.

Digital Citizen

The second ISTE (2016) student standard is related to helping students to build awareness and become positive digital citizens. A digital citizen is a student that can recognize and understand the rights, responsibilities, and opportunities of living and working in a digital world that is interconnected, and who makes choices that maintain a high level of safety, legality and ethics (ISTE, 2016, para 2). Kiger and Herro (2015) conducted a quantitative study using survey questionnaire results from 482 parent participants and based on analysis of the results they reported that there is a statistically significant connection between the use of ICT in a bring your own device program, where student use their own private devices during class, and the strengthening of digital citizenship among students in K-5 environments and beyond. This shows, that when students are given the opportunity to use their own ICT this has often been used as an opportunity to teach them about digital citizenship. Districts that have enacted a bring your own device policy recognize the value in students having access to content that can only be obtained online such as podcasts, and online libraries.

Some educator-practitioners, such as Szmodis and Columba (2013) have been communicating the importance of computer supported collaborative learning and open educational resources in the form of podcasts, games, digital libraries are needed to create and sustain authentic, engaging, and hands-on lessons that help improve literacy skills and digital citizenship. However, there is a lack of evidence that this is occurring at the

K-5 level even though ICT is a tool that can be integrated within lessons and activities to promote student digital literacy and digital citizenship.

For instance, in a qualitative study, Malecki (2018) interviewed public elementary school teachers and found that teachers were concerned that cybersecurity precautions like secure usernames and passwords, should begin early with elementary students who use ICT in classroom. Teachers know the importance of integrating digital citizenship elements into lessons to teach students about online safety (Malecki, 2018). During lessons when students have access to ICT, cybersecurity and cyber bullying can be mentioned as a part of the whole lesson to support the digital literacy element of online security. Research over eight years presented at a conference by Žufić, Žajgar, and Prkić (2017), included the survey results of 1232 elementary students asked about their ICT use and knowledge of cyber bullying. The survey involved participants who were students from the first through eighth grade of the elementary school, 7-15 years of age. Analysis of survey results lead the researchers to conclude that students have a low digital literacy level regarding online safety and digital citizenship which is why the authors recommend increased parent and teacher efforts to prevent cyberbullying and risky online behavior. The conclusions reached by the researchers based on the empirical data were that teachers need to invest more time and effort to teach about digital citizenship and concerns like cyber bullying. Digital citizenship is a critical component to incorporate into curriculum to positively support the overall digital literacy for students which may impact their ability to stay safe online and to use ICT well now and in the future.

Knowledge Constructor

The third ISTE (2016) student standard specifically addresses how students construct their knowledge and understanding by gathering digital resources and using a variety of tools to make their learning meaningful. Fluency in the utilization of ICT to construct knowledge is a critical skill to have as a learner in today's classroom. Author and researcher Siemens (2014), posited that it is more important in education to be able to locate information rather than to memorize (p. 5). In the learning process students must be able to seek out knowledge from a variety of sources and create their own meaning. Kearney, Burden, and Rai (2015) reported survey results from 107 teacher participants, nearly 40% who were elementary teachers, that showed that teachers who incorporate ICT into instruction reported online collaboration, networking, and motivation for independent student learning was lower than the researchers had expected. This study highlights the need for increased support for teachers and students to learn methods of ICT integration to increase student's knowledge construction with digital resources and information.

In addition to teacher surveys, student surveys provide further insight into the potential effects that ICT use can have on student literacy and overall learning. For instance, Furió et al. (2015), conducted a quantitative study using five questionnaires comparing the effectiveness and satisfaction of 38 children between the ages of 8 and 10 years old using iPhone apps to learn about content. Using multifactorial ANOVA analysis, the questionnaire results revealed that there is a statistically significant correlation between student use of ICT and knowledge measured by test scores compared

to traditional classroom methods without the use of ICT. Students given the opportunity to learn using ICT tend to have a higher level of motivation and engagement which lead to a higher level and of knowledge construction.

Providing context in student learning is an essential practice. Ruggiero and Mong (2015) highlighted the importance of contextual learning in their study which reports the results of 1048 teacher surveys who taught in grades K-12 (48% with students ages 5-10), with 10% randomly selected participants for follow up interviews in a mixed method study to determine what technology is used in the classroom and how it facilitate student learning. Using descriptive statistics and thematic analysis the researchers conclude that students need to use ICT in context and apply it to content to build understanding. Seamless integration within the context of content is critical in the process of a student constructing knowledge. Practitioners like Szmodis and Columba (2013) share the urgency of increasing a students' access to ICT as early as kindergarten due to the benefits such as the expansion of student knowledge and higher-level thinking via ICT use. In the mixed-method action research study conducted by Hamilton-Hankins (2017) the connection between ICT use and potential benefits using data analysis from 10 second grade students in the form of quantitative data through student engagement checklists and questionnaires, qualitative data derived from interviews, observation field notes, and post-interviews was reported as yielding a high level of student engagement and participation in learning when students used ICT. There are benefits for making ICT available for student use, and among those are higher levels of engagement and thinking that lead to a solidification of knowledge. Knowledge construction using a variety of

tools to make learning meaningful is an essential part of the overall digital literacy of a student.

Innovative Designer

The third ISTE (2016) student standard is innovative designer. According to ISTE (2016), students "should be able to use a variety of technologies within a design process to identify and solve problems by creating new, useful imaginative solutions" (ISTE, 2016, para. 2). Sáez-López et al. (2016) concluded that there are benefits such as increased motivation, enthusiasm, and potential improvements related to opportunities for students to use ICT to create, based on their evaluation of outcomes from interviews and surveys of 107 primary school students. The conclusions reported by the researchers are that students felt there are benefits for using ICT such as programming software in an educational context which yielded a positive result when learning is focused on creation and development of projects.

Software can complement the educational process by creating additional opportunities for students to innovate/create in ways that are not possible otherwise, thus allowing for demonstrations of mastery at higher levels. One conclusion drawn from the analysis of data based on results from three interviews of one elementary teacher, who integrated interactive white boards into instruction, was that he felt there was an increase in his students' creativity and innovation when using ICT in the classroom (Lindberg, Olofsson, & Fransson, 2017). Lindberg et al. (2017) also noted that students who used ICT in this classroom were interested in doing additional activities and designing other projects as a result of the integration of this new technology. ICT can bolster student

engagement, creativity, and enthusiasm for learning when integrated properly. Urbina and Polly (2017) provided a contrasting result in a qualitative study based on empirical evidence generated from elementary teacher interviews and elementary student observations in three schools that ICT did not increase the creative design for students in a one to one ICT to student ratio environment due to the way that students were directed to use Chrome books.

When teacher expectation for student use is low, the capacity for creation and innovation with ICT is also low. Collectively these studies show the importance of how a teacher has students use technology. Teachers have the ability to enkindle or stifle student imagination with activities that promote creative design and demonstrations of learning that can surpass paper and pencil-based activities. When a student is given support and freedom to expand and demonstrate their creativity, design skills, originality, and ingenuity in a content area through the use of ICT, technology literacy is strengthened.

Computational Thinker

The fourth ISTE (2016) student standard is computational thinker, which means that a student can leverage ICT in a way that allow for them to solve problems by creating and testing solutions in new and different ways. Angeli et al. (2016) acknowledged that there is not a universal definition of computational thinking, so they developed a framework of computational thinking specifically for K-6 students. They concluded that the literature agrees that computational thinking included five elements: abstraction, generalization, decomposition, algorithmic thinking, and debugging. Abstraction is the ability to differentiate between essential and non-essential information.

Generalization is when students create a transferable solution to multiple problems. Decomposition is the ability to break complex problems down into smaller problems to make arriving at solutions easier. Algorithms is the skill to develop the correct procedure or process for creating a solution and debugging is the skill to identify and correct errors (Angeli et al., 2016, p. 50).

There is empirical evidence that substantiates that ICT can support an increase in student computational thinking. Israel, Pearson, Tapia, Wherfel, and Reese (2015) reported the results of their study to understand how computational thinking was integrated in K-5 instruction using cross-case analysis, based on data generated from observations and interviews of 20 K-5 teachers whose students used new educational software. Results showed that student computational thinking increased because of the integration of software. The development of a student's capacity to use ICT to solve problems can be augmented when ICT is utilized in concert with best practices. In a similar study, software was introduced for student use and Sáez-López et al. (2016) concluded based on empirical evidence from a quasi-experimental mixed-method study that introducing coding software like the web-based program *Scratch* significantly improves student computational practices. When teachers choose to give students the option to use software like the online software like *Scratch*, where students practice coding, they are able to build computational skill and technology literacy. Avraamidou (2013) conducted interviews with 16 students in fifth grade and found that when ICT is used in investigational lessons, students felt they had a greater ability to analyzing data, make graphs, and construct explanations. The use of ICT in this study allowed for an

increase in student effectiveness for computational thinking and demonstration of their learning. Computation thinking is an important part of technology literacy, and when ICT is an effective part of the educational process students can demonstrate effectiveness in this domain.

Creative Communicator

A student who is a creative communicator is one who can communicate clearly by expressing themselves in innovative ways using a variety of platforms, tools, styles, formats, and digital media appropriate to their goals (ISTE, 2016, para. 2). ICT is a tool that can increase a student's capacity to communicate in ways that are unique and innovative. For instance, Chia-Wen, Pei-Di, and Rong-An (2015) conducted a quasi-experimental study using data collected from teacher journals, student interviews and observation while grade six students were engaged in creating multimedia projects in a digital story telling course. Data showed that student performance in communication and overall ICT literacy throughout the course was superior compared to those whose teacher did not use ICT. Student ability to be creative in the way they communicate in a digital platform was elevated because of ICT use. In another study, researchers analyzed the effects that a novel use of ICT could have on student learning on fifth grade students using blogging to engage students and develop capabilities in ICT and improve literacy skills. The action research project conducted by Chamberlain (2017) included analysis of data from the observation of fifth grade students as they used the blog platform *Edmodo*. Results led Chamberlain to conclude that there was significant improvement in students'

critical literacies, collaborative/communication skills demonstrated through common assessment performance.

When teachers apply ICT in creative ways that increase student engagement, academic success and appropriate technology literacy is possible. When a student's perception of their own growth in literacy and communication is evident, it can be a powerful way to motivate further academic and personal growth toward mastery. In a multiple case study by Allison and Goldston (2016), where empirical data were generated from student semistructured interviews and observation, and from semistructured teacher interviews, data showed that students perceived that ICT was effective in allowing them to increase their ability to communicate. Student who may perceive and be aware of their own success when using ICT to achieve higher academic performance, may continue on their path to greater success. Teachers who which for their students to possess the skills to communicate effectively and creatively to gain deeper technology literacy may leverage ICT to accomplish this.

Global Collaborator

The fifth ISTE (2016) student standard is global collaborator. Students who are global collaborators use digital tools to expand their knowledge and beliefs while also enriching their learning by collaborating with others and working effectively in teams locally and globally (ISTE, 2016, para. 2). A review of current literature pertaining to appropriate technology literacy for K-5 students and the characteristic of global collaborator identified by ISTE has led to the identification of a gap. Little empirical

research can be found on global collaboration, however, there are examples of local collaboration.

An example of students who are effective local collaborators are those who use means such as ICT platforms to cocreate multimedia presentations to report results to an experiment. For instance, in the interviews conducted Avraamidou (2013) with 16 students in fifth grade students reported that they could communicate and collaborate more effectively with each other and with those outside the classroom. The use of ICT in this study reported an increase in student effectiveness due to the expansion of opportunities for student collaboration. In another study, Schellinger et al. (2017), focused on the engagement of 125 fifth grade students who experienced scientific inquiry with the use of ICT by administering a questionnaire with both open and closed ended questions. Data showed that when a curriculum was built with ICT use included, students felt that proficiencies in productivity, collaboration, and overall scientific knowledge is supported and positively impacted. Students had enhanced collaboration due to their ability to share data easily with each other with the use of hand-held devices which stored the recorded data from observation and experiments. When teachers have their students use ICT with sound instructional methods of integration, students have greater access to information and heightened contextualization of learning. Students might also show an increased level of skills like online collaboration while using ICT with good practices.

Kearney et al. (2015) reached a conclusion after analyzing the survey results and noted that of teachers who used ICT with sound practices, students demonstrated higher levels of aptitude for online collaboration, networking, and motivation for independent

learning. One example of truly global collaboration through the use of ICT can be found in a study with students who live in Scotland and Zambia. Kynaston (2015) conducted a mixed method study analyzing the transcripts of videoconferences, text within student written letters, and responses to questionnaires. Kynaston concluded that students became more knowledgeable about Zambia and African culture when participating in activities like video conferencing and other ICT. Student perceptions grow when they build on what they already know when given the opportunity to connect with other classrooms worldwide.

Collaborating globally can be a powerful example and resource to students to support the expansion of their context and technology literacy. A student who can be considered a global collaborator encompasses a wide variety of skills and practice. The collaboration can be as simple as working synchronously with a classmate on the creation of a Google Slides presentation, or as complex as authoring a digital book with other classrooms around the world. When teachers empower student collaboration with ICT there is no limit to the learning that can potentially take place.

How Teachers Have Their Students Use Technology

K-5 teachers may successfully have their students use ICT in a variety of ways, and sometimes perceive that this practice is not without its challenges. The current literature includes how teachers use ICT in their pedagogical practices which may include the use of mobile devices such as tablets, smart phones, laptops, personal computers, video cameras, interactive white boards, internet, and a spectrum of online and offline software programs. Various approaches have been used to study K-5 teacher and student

use of ICT such as augmented reality, game-based learning, blended-learning, online learning. In order to address the first research question which asks how K-5 teachers have their students use ICT in the classroom, the SAMR model was used to analyze and ICT use in four categories: substitution, augmentation, modification, and redefinition (Puentedura, 2006). Therefore, in this portion of the literature review I organized and synthesized empirical research studies that describe student use of ICT according to the SAMR model categories.

Substitution

The first level of ICT use in the SAMR model is substitution. ICT use in this level of the model is characterized by technology acting as a direct substitute for another tool, with little to no functional change (Cherner & Smith, 2017; Puentedura, 2013). An example of substitution level use of ICT was described in a literature review examining elementary teachers and students (Delgado, Wardlow, McKnight, & O'Malley, 2015). The kinds of ICT and use at the substitution level are depicted as interactive white boards used for simple responses (Aubusson et al., 2014; Delgado et al., 2015; Kaware & Sain, 2015; Martin & Carr, 2015; McDermott & Gormley, 2016), cameras for capturing images (Delgado et al., 2015; Hernández-Bravo, Cardona-Moltó, & Hernández-Bravo, 2016; Share, 2015), MP3 players for listening to recorder material (Kaware & Sain, 2015), and mobile devices for students to practice math and reading skills (Domingo & Garganté, 2016; McDermott & Gormley, 2016; O'Bannon et al., 2017; Ulrich & Nedelcu, 2013). The technology use at this level serves as a digital substitute for practices previously accomplished using no ICT.

Student use of technology at the substitution level provides opportunities for students to use ICT for activities that might also be possible without the use of ICT. For example, technology used at this stage includes students who use digital flashcards to replace paper ones (Kaczorowski, Hashey, & Di Cesare, 2018), digital manipulatives for physical ones (Bartha et al., 2016; Martin, Shaw, & Daughenbaugh, 2014), typing rather than handwriting (Amr et al., 2016), and read electronic books instead of paper ones (Lupo, Jang, & McKenna, 2017). However, even technology implemented at the substitution way can influence elements of a students' learning experience or improve their achievement. Elementary students using a smart board in place of a chalk board responded to a survey about their reaction to using the smart board for learning activities; the resulting analysis of the survey showed that students preferred using the smart board (Gurbuzturk, 2018). Smart boards might be used for simple substitution, but that does not diminish the potential engagement and benefit that might be possible. Johannes, Tsertsidis, and Islam (2016), observed and interviewed 7 to 10-year-old students in elementary classrooms in an attempt to investigate how they interact through ICT, and if the use of ICT contributed to the overall development of their academic competency. Researchers noted that students who use laptops, tablets, and smartphones to access online resources are more engaged and higher levels of competency are achieved, but ICT is not being used to the fullest extent because learning tasks remain at the substitution level of the SAMR model. In another empirical, mixed methods study, data were collected in an elementary setting by observation, teacher and administrator interviews, and surveys given to four teachers (Vrasidas, 2015). Data analysis led

researchers to conclude that a relationship exists between a teachers' access and support to use ICT for student learning. Since teachers' perceptions were that they did not have a great degree of access or support, researchers correlated that to low levels of ICT integration meant that technology was used to solve problems, look up information, work individually, and to play games, all which fall into the substitution category of the SAMR model. Substitution is appropriate in some instances of learning, but students who have access to ICT may have the potential to do more than access information. Although examples of ICT being used by K-5 students at the substitution level has not been researched to a large extent, a thorough review of current literature has uncovered examples at the secondary level (Blikstad-Balas, 2015; Budiman, Rahmawati, & Ulfa, 2018), and in higher education (Biddix et al., 2016; Farley et al., 2015; Wang, Wang, Gaskin, & Wang, 2015).

Although substitution is the lowest form of ICT integration, elementary teachers are often motivated to have students use technology at this level for a number of reasons. When teachers plan learning activities for students, they must consider the number of devices available for student use. Teachers who use ICT at substitution level perceive challenges such as unequal access (Aubusson et al., 2014; Ruggiero & Mong, 2015), issues with classroom layout and available space (Tondeur, De Bruyne, Van den Driessche, McKenney, & Zandvliet, 2015), and lack of training and professional development (Ruggiero & Mong, 2015). However, teacher perception of successes included increased student interactivity (Öman & Svensson, 2015), and perceived

positive impacts on student achievement (de Aldama & Pozo, 2016; Domingo & Garganté, 2016; Hlasna & Klimova, 2017; McDermott & Gormley, 2016).

Augmentation

The second level of Puentedura's (2006) SAMR model is augmentation. Use of ICT at the augmentation level is defined as technology use that acts as a direct substitute, with functional improvement for an activity (Cherner & Smith, 2017; Puentedura, 2013). The kinds of ICT and use at the augmentation level are depicted as, students using mobile devices (Rivera et al., 2017; Ulrich & Nedelcu, 2013), students viewing videos (Chen & Cowie, 2014; Hernández-Bravo et al., 2016), students working in online platforms (Hernández-Bravo et al., 2016), students using software-based word processing (Erwin, 2016), and using social media (Kaware & Sain, 2015).

ICT research highlights examples of elementary teachers who have students use ICT at the level of augmentation. For example, in Varma's (2014) mixed method study with 64 first through third grade students, the lesson included the use of hand-held computers to measure the change in temperature while gauging the effectiveness of various insulation materials. The use of the hand-held computer allowed student to record measurements and share them more efficiently with other classmates and teachers. This was a functional improvement from paper and pen recording and sharing. Another example of ICT used at the augmentation level of the SAMR model is in a study using teacher interviews, focus groups, and observations in both primary and secondary classrooms to ascertain if video recordings of scientists is effective in engaging students (Chen & Cowie, 2014). Based on thematic analysis of data collected from the interviews

and observations teachers perceive that student's engagement and interest in the lesson increased due to the videos shown. This example of ICT in the form of videos as a way to deliver content and engage students functions as augmentation, a functional improvement due to increase in remote one-way asynchronous communication.

In the literature ICT is often used as a means to design and present student knowledge. In the mixed method study by Ulrich and Nedelcu (2013) conclusions were drawn based on empirical evidence gathered from observations, semistructured interviews of students and teachers, photo analysis, and questionnaires submitted by third and fourth grade teachers whose students used laptops, iPads, and smartphones to create and present their designs. In this instance, ICT is substituted for pen or pencil with paper for creating presentations on cardstock which provides a functional improvement. An instance where the use of ICT at the augmentation level of the SAMR model is deliberate and appropriate was found in the study by Rivera et al. (2017) where by quantitative methodology data were collected from pre and post assessment given to three students. Students interacted with images and words on iPads to improve digital literacy skills and based on analysis of assessment data the skill level of the participants was increased. While the students only used the iPads for recognition of digitally rendered images and text, which was substituted for printer materials, functionality was improved and the goal to increase student digital literacy skill was achieved. In another study, Villányi, Martin, Sonnleitner, Siry, and Fischbach (2018), analyzed the assessment results of 191 Grade 3 and 4 students as they engaged with a self-assessment software application. Researchers concluded that students benefited from the ability to manipulate the stimuli in the

assessment on a tablet. This example of how students used technology falls into the augmentation category due to the functional improvement in the learning activity. In a practitioner journal article written by Erwin (2016), ICT use in the form of a computer and projector were described to aid a students' sight word recognition. The practice included students being able to see the words and images as a whole group improved the choral response and overall sight word recognition. The teachers' use of the classroom computer and projector is an example of ICT used at the augmentation level of the SAMR model due to an improvement in the overall functionality of the activity which seems appropriate for the intent of the lesson. When a lesson and the level of rigor may not require higher levels of analysis or synthesis a teacher might choose to have student use ICT at an augmentation level. For instance, McKnight et al. (2016), in a mixed-method study, collected data via focus groups, interviews, observations, and a survey completed by teachers. During observations, researchers noted that students would perform research, exploration, assessments, and collaboration on assignments and during lessons. The use of ICT by students is appropriate for the rigor and outcomes desired by the teachers, classified as augmentation because there is a function improvement in a student's ability to conduct research, explore resources, take assessments, and collaborate in class.

The augmentation of a task through the use of technology provides students the opportunity to engage in a learning activity that includes a functional improvement. A synthesis of conclusions from previous studies confirm that when teachers plan for student use of ICT at this level, a perception exists that student have access to increased

opportunities for collaboration and effective communication (Kaware & Sain, 2015; O'Bannon et al., 2017). Teacher and student perception of ICT at the augmentation level of the SAMR model is positive mainly due to students increased ability to communicate and collaborate when ICT is made available (Kaware & Sain, 2015; O'Bannon et al., 2017). However, teachers also perceive that ICT may not be a viable option due to the restrictions of curriculum and loss of instructional time if something were to go wrong (Alenezi, 2017; Aubusson et al., 2014; Ruggiero & Mong, 2015). Sociocultural factors like access to ICT were also major factors which influenced teacher perception of student use of ICT at the augmentation level (Ulrich & Nedelcu, 2013). After a thorough search for examples on elementary teachers who have their students use ICT at the augmentation level of the SAMR model, and elementary teacher perception of students using ICT, few were found.

Modification and Redefinition

Modification and redefinition comprise the next levels of the SAMR model. Task modification with ICT is defined as a use of technology which allows for a significant redesign of an educational activity (Cherner & Smith, 2017; Kadry & Ghazal, 2019; Puentedura, 2013). Redefinition, the highest level of the SAMR model, is defined as technology that allows for the creation of new tasks that could not have been done without the use of technology (Cherner & Smith, 2017; Puentedura, 2013). These two levels together are called transformation. The kinds of ICT and use at the these higher SAMR model levels include attending virtual field trips (Anderson et al., 2016), creating digital stories and storytelling (Song & Wen, 2018), collaboratively creating digital

movies (Öman & Svensson, 2015), game-based learning (Furió et al., 2015; Liao, Yu, & Wu, 2015), and for learning with augmented and virtual reality using smart devices (Furió et al., 2015; Kaware & Sain, 2015).

ICT research that examine examples of elementary teachers who have students use ICT at the level of modification or redefinition levels of the SAMR model are fewer than those at the substitution and augmentation levels. The first example of student use of ICT at the modification level is in a mixed method study where 42 third graders used software to create a multimedia presentation of themselves retelling a story (Song & Wen, 2018). Analysis of the student interviews and assessment data showed that the task, modified by the use of technology, increased the mastery of students who used the software compared to those who did not, and increased student engagement and enjoyment in the learning task (Song & Wen, 2018). It is possible that allowing students to use story telling software may be able to better support the effectiveness of student learning and achievement because it allows for greater student personalization. Furthermore, in another study 29 third grade students used iMovie with a Mac computer to create a digital movie about what they learned from a lesson about the solar system. Using a microethnographic approach, Öman and Svensson (2015), used video recordings and informal interviews to gather data. After analysis, they concluded that ICT was beneficial to make student learning visible and to encourage communication and collaboration among small teams of students. ICT used at the modification level gave students an opportunity to display their knowledge in a medium where mastery of a skill is more evident to the teacher, and in an environment more conducive to collaboration

and communication. Another example of ICT uses at the modification level of the SAMR model involved 52 second grade students who participated in a mixed-method study by playing a math content-based adaptive game on an iPad to evaluate the effects on their own self-efficiency in using technology for learning (Liao et al., 2015). After analysis of student questionnaires and informal interviews researchers concluded that the majority of students reported a perception of heightened engagement, satisfaction, and self-efficacy when using the application compared to not using it. It seems that when teachers decide to have students use ICT for learning at the modification level of the SAMR model, there are benefits which will help bolster student achievement. Perhaps the decision to have students use ICT itself is not transformative; it might be the way in which students use it.

The first example of redefinition, where elementary students used ICT in a way that allowed for new tasks that are not possible without the use of technology, involves learning with augmented reality. Seventy-five primary students learning about anatomy and physiology used tablets and a software application that allowed them to see inside the respiratory and circulatory systems. Researchers concluded that based on six evaluations and a questionnaire given to students that they were able to comprehend and retain information about content compared to students who did not participate with the technology. It seems that when students are able to engage with content in various contexts they may retain more of what they learn. iPhones and tablets were used to learn in virtual reality by 38 elementary students in Spanish classrooms (Furió et al., 2015). Student played augmented reality mini games to learn content-based skills. Analysis of data gathered by pre and post assessments led researchers to conclude that the students

who played the minigames performed higher compared to those who did not play. Further examples of learning activities where elementary students used technology at the level of redefinition were found in a practitioner journal article where fourth grade students used iPads to reproduce simulations of earthquakes and collect data (Anderson et al., 2016). In this virtual experience students were able to take part in the real-world learning context of architecture and design to minimize potential damage from earth quakes. It may be easier for teachers to create an authentic learning environment for students using ICT at the redefinition level of the SAMR model. Another example of students using ICT for scientific inquiry at the redefinition level, was found in a mixed-methods study where 125 fourth and fifth grade students used iPads and the internet to investigate the behavior of animals in their habitat (Schellinger et al., 2017). Students collected data and recorded it in an iOS app, shared data with classmates in real time, wrote observations and created presentations to demonstrate their learning, and wrote reflections in a blog platform where other students and teachers could provide feedback (Schellinger et al., 2017). This activity was redefined due to the introduction of ICT into the learning process providing students the ability to share their measurements and thoughts, and reflections in real time and all in one location within the application. Another elementary example of technology used at the redefinition level is when students virtually traveled to the distant Antarctic continent to help scientists track the behavior of penguins and other wildlife through satellite images uploaded to a website and made available to the public (Ylizarde & Shockley, 2018). Students are encouraged to make notation of what they see in an effort to supplement the documentation of researchers who study the region. Teachers are able

to provide authentic and redefined learning opportunities to students through the use of ICT as students observe and record what they see even in an environment that is thousands of miles away in a dangerous and desolate environment.

Understanding teacher perceptions of student use of technology is an important factor to consider when looking at how teachers have students use technology, particularly at the higher enhancement levels, of the SAMR model. For instance, when a teacher perceives that ICT might provide students access to outcomes such as higher levels of collaboration, communication, and critical thinking, they might be more apt to decide to have students use ICT at the redefinition level of the SAMR model (Öman & Svensson, 2015). Learning tasks can become transformed at the modification level when student use software like iMovie to create a multimedia video (Öman & Svensson, 2015; Song & Wen, 2018), or online learning management systems to interact virtually (Karsenti & Bugmann, 2017), and tablets or computers for game-based learning (Liao et al., 2015; Kaware & Sain, 2015). Teachers who choose to have their students use ICT at the highest levels of the SAMR model can transform learning tasks for their students when they design learning activities such as learning in virtual environments like augmented reality (Anderson et al., 2016; Furió et al., 2015).

K-5 Teachers' Technology Integration Decision-Making

Decision making of K-5 teachers in this study was analyzed through the lens of the TAM by Gu et al. (2013). There are four elements that comprise the TAM: outcome expectancy, TTF, social influence, and personal factors. One or all elements can be applied to account for, predict and understand teacher decision-making to have their

students use ICT. Gu et al. provided empirical evidence-based research on how to understand the extent and nature of the decision-making process of teachers as they decide for their students to use ICT from the perspective of technology acceptance. Teachers play a pivotal role in the process of ICT integration, and technology integration is planned and designed by the teacher in order to benefit their students. Gu et al. noted that knowing the difference in technology acceptance among teachers could support the development of future technology as well as ways to foster more robust ICT integration (p. 392). However, in my review of the literature, I focused on any study related to K-5 teacher technology integration decision-making, not only those who specifically used the TAM to frame the study. I examined results of the study and determine what element of the TAM they might fall under and discussed the results collectively. Therefore, I will discuss the literature organized by outcome expectancy, TTF, social influence, and personal factors.

Outcome Expectancy

When a teacher begins the process of decision-making, one of the first considerations is the perceived usefulness of the technology, or outcome expectancy. A teacher may assess the relative advantage or performance expectancy of the ICT by determining what is the perceived benefit of using ICT over another resource or tool. Outcome expectancy has been attributed as the most effective way to anticipate a person's expected use of ICT. This construct has been addressed as perceived usefulness, ease of use, relative advantage, and performance expectancy in other technology acceptance models (Davis, 1989; Venkatesh et al., 2003). Understanding how a teacher

perceives the effectiveness of ICT by how their students' successful mastery of a skill using ICT is an important aspect in overall understanding related to the decision-making.

In the decision-making process regarding teacher ICT implementation, teachers often expect certain outcomes that influence that decision. The first is increased engagement. Teacher perception of the benefits of using a tool like ICT is an important factor in decision-making. Uluyol and Şahin (2016) surveyed 121 elementary teachers about the motivation for deciding to have students use ICT. Analysis of survey results showed that one of the top motivations among teacher participants were benefits for students, expectations that the use of ICT would increase students' attention, ownership, and involvement with support for an increase in academic success. According to Domingo and Garganté (2016) one conclusion reached in their quantitative study using data gathered from questionnaires submitted by 102 teachers was that perceptions of ICT have a significant influence on teaching practices. Data analysis showed that teachers perceived ICT as a way to increase engagement in learning, and to facilitate student access to resources and information, and the researchers concluded that when teachers decide to use ICT they consider the impact on student learning (Domingo & Garganté, 2016). When a teacher perceives that their students will be more engaged and have greater access to information and resources through the use of ICT, their inclination to decide to have students use ICT seems more likely. When most teachers perceive that their students will benefit from a resource or tool like ICT they are more likely to decide that their students should use it. After analyzing data from a survey questionnaire given to 101 teachers using descriptive and inferential statistics, researchers Ghavifekr and

Rosdy (2015) concluded that teachers perceive students are more focused and engaged in learning when using ICT and therefore perceive that ICT use is beneficial.

Another outcome that teachers expect when deciding to use ICT is increased student understanding of content. For example, Biddix et al. (2016) conducted an educational study where 59 elementary teachers were given an online survey where researchers used statistical and semantic analysis of the qualitative responses to determine perception of ICT use. After analysis one conclusion was evident; teachers perceived that student understanding can be increased through ICT use, which in this study was through the use of mobile devices. The last outcome is related to teacher expectations of improving student overall performance. For instance, in a quantitative study by Scherer, Siddiq, and Tondeur (2019), 1,190 elementary teachers perceived usefulness of ICT for teaching and learning, the degree to which they believed that ICT would increase their students' performance, was measured using a questionnaire. Results showed that when teachers had a positive perception on the outcome of student use ICT, such as assessment and feedback, student collaboration, and the development of students' skills there was a positive correlation to a teacher's intent to use ICT. When a teacher perceives that a tool will help students internalize skills, they are more apt to use the tool. In a similar vein, performance-expectancy is also a statistically significant predictor of teacher decision-making to use ICT. For instance, Tosuntaş, Karadağ, and Orhan (2015) concluded that performance-expectancy from perceived usefulness of ICT has a positive statistically significant relationship with a teachers' behavioral intention to use ICT such as an interactive whiteboard based on the analysis of a questionnaire given to 158

elementary and secondary teachers who use interactive whiteboards in their classroom. In addition, there is empirical evidence that perceived usefulness is a strong predictor of technology acceptance. For instance, Akar (2019) gave a questionnaire to 121 primary school teachers who responded that the perception that technology would help them perform their job was a strong motivation to use it in class. Perceived usefulness or performance expectancy is an insightful predictor in the decision-making process of a K-5 teacher interested in integrating ICT for students to use. If a teacher perceives that ICT is beneficial and that there is a relative advantage for students, then there is a favorable chance that they will decide for their students to use ICT.

Task-Technology Fit

During the decision-making process, a teacher may also take into consideration the degree to which ICT may increase the performance of a task either helping teachers with instruction or assisting students in learning. TTF has also been addressed as effort expectancy, when ICT meets the task needs of the teacher or student and has a positive impact on learning or teaching (Gu et al., 2013). One of the ways that TTF is perceived by teachers is whether ICT will have a positive impact by increasing teacher performance. For instance, empirical evidence provided by Tosuntaş et al. (2015) from analysis of a questionnaire given to 158 elementary and secondary teachers who use interactive whiteboards in their classroom, concluded that effort-expectancy, the perception that using ICT would increase teaching performance, has a statistically significant relationship to behavioral intention to use ICT such as the interactive whiteboard. In another similar study, teachers place great value on a tool increasing their

abilities to deliver content. Elementary teacher decision-making may be closely related to professional use of ICT for increasing performance in teaching. Heitink, Voogt, Verplanken, van Braak, and Fisser (2016) explored this relationship in a mixed-methods study where 117 elementary teachers submitted a video and responses to a questionnaire. Analysis of data led researchers to conclude that teachers perceived that the use of ICT would strengthen their abilities in pedagogy and increase efficiency in delivering content. Teachers may be inclined to decide to use ICT for teaching and learning based on the technology-fit which may allow for expedient content delivery.

Another element that influences teacher decision-making related to TTF is if the application of ICT saved time. TTF assumes that a person will accept the ICT because of the possible benefits that may result which include saving time. In the study by Uluyol and Şahin (2016), where 121 elementary teachers were surveyed about the motivation for deciding to have students use ICT, analysis of survey results showed that among teacher motivation to choose student use of ICT was that it would increase support for student and teacher performance and save time.

Student perception of ICT use in class is another factor that teachers may consider when determining TTF. van Deursen, Allouch, and Ruijter (2016) studied 139 primary school children's perception of ICT in the form of tablets and ease of use, analyzed the data from questionnaires in six primary schools and concluded that factors which affect perceived ease of use of the tablets were based on technical issues such as device capacity and strong connectivity to a network. The students felt overall that when they had strong connectivity and access to a device that had adequate storage, ease of use was

high. Students who were frustrated were unwilling to use a device when it did not function properly due to connectivity or capacity issues. Throughout the decision-making process that a K-5 teacher may undergo in deciding if they want their student to use ICT, considerations like effort expectancy, technology compatibility, and ease of use are heavily influential on the outcome of the conclusion.

Social Influence

Education in K-5 is a social process performed in a social environment. The influences exerted by others and external factors on perception is a strong predictor of decision-making. Gu et al. (2013) suggested that the social influence construct in technology acceptance is a teacher's perception that a person or organization want them to use ICT. Teachers on a campus may experience a kind of social pressure which impels them to use technology (Gu et al., 2013). Social influence includes such stimuli as information and observation from other teachers and students (van Deursen et al., 2016). Teachers may have the ability to make decisions about what happens in their classroom, however there seem to be other factors that are outside of a teacher's control. In the review of literature on K-5 teacher decision-making, three themes seemed to immerge under the element of social influence: collegial, external infrastructure, and access or availability.

The first theme under the element of social influence was collegial influences. The social influence of a colleague either by communication or observation in technology acceptance seems to be a significant factor for technology acceptance and a critical consideration for understanding and predicting teacher decision-making to use ICT. For

example, in the study by Uluyol and Şahin (2016) analysis of survey results showed that among teachers' motivation to choose student use of ICT, the second most frequently occurring motivation was the influence of colleagues who suggested, encouraged, or inspired them. Furthermore, the influences of others such as local and remote colleagues play a large part in teacher decision-making. An example provided by Tosuntaş et al. (2015) in a qualitative study, conclude after analysis of a questionnaire given to 158 elementary teachers that social influences, a teacher's perception about what other teachers believe, has a statistically significant relationship to behavioral intention to use ICT such as the interactive whiteboard.

The second factor that has a bearing on K-5 teacher decision-making to allow students to use ICT is community, district, or campus infrastructure. Teachers who choose not to have student use ICT may do so because of factors that are outside of their control. For instance, Alenezi (2017) interviewed teachers who choose for their students to use ICT in class and based on analysis of data generated from observation and participant interviews, Alenezi concluded that the significant factors that impeded use of ICT was the district information technology department, policies and security restrictions, and lack of wireless network connectivity. Although this infrastructure theme was not prominent in studies focusing on K-5 teachers, issues around infrastructure are well documented at the middle school level (Gil-Flores, Rodríguez-Santero, & Torres-Gordillo, 2017) and at the high school level (Albugami, & Ahmed, 2015; Nikolopoulou, & Gialamas, 2016). All of which limited instructional freedoms and ability to communicate new ideas with students and colleagues.

The third theme that immerged under social influences was access and availability to equipment and a network. Access to technology is a social factor that can be used to predict and understand K-5 teacher decision-making. Environment has been empirically shown to have an effect on a teacher's attitude when deciding to use ICT. Kusano et al. (2013), surveyed 166 elementary teacher participants from Japan and the United States to compare how two different environments might affect use of ICT. Based on analysis of the survey data the factors identified as the most statistically significant predictor for K-5 teacher use of ICT was access and availability of equipment and connectivity to a network. Although K-5 teacher perceptions of factors relating to access and availability of ICT is not well documented in research, there are many studies that focus on middle school teacher perceptions (Gil-Flores et al., 2017) and high school perceptions (Albugami & Ahmed, 2015; Nikolopoulou & Gialamas, 2016). In another study, Liu and Pange (2015) collected questionnaires from early childhood teachers to better understand the perception of barriers in decision-making to use ICT. Liu and Pange concluded that the greatest perceived barrier was lack of access to equipment. In summary, the social aspects that influence teacher decision-making range from collegial interactions to environmental factors sometimes beyond the control of a teacher.

Personal Factors

The final element of the TAM that is empirically used to understand and anticipate decision-making of K-5 teachers to have their students use ICT is personal factors. Personal factors, also described as perceived self-efficacy, readiness, or technology comfort in other studies, account for the greatest statistical significance

relating to K-5 teacher decision-making (Gu et al., 2013). Factors such as self-efficacy, personal effort expectancy, personal innovativeness, emotional influences, preconceived notions, and current perceptions of ICT all seem to play a large role in this element of technology acceptance. One of the factors that influence a K-5 teacher decision-making under the element of personal factors is the self-efficacy or comfort that a teacher has using a form of ICT. Petrovic, Pavlovic, and Soler-Adillon (2016) collected 110 questionnaires from Kindergarten teachers who reported insufficient levels of personal experience with ICT. Researchers noted that this was a significant factor in teacher decision-making. If a teacher does not feel comfortable with a resource it seems they will be less likely to use it in class. In another study, Alenezi (2017) interviews elementary teachers and concluded that lack of comfort with technology was a determinant for decision-making to use ICT. Similar results were found by Hatlevik (2017) who surveyed 332 primary and secondary teachers where they self-reported perceptions of their own digital competence. One conclusion reached from analysis of data was that self-efficacy is an important factor in teacher decision-making process to have students use ICT. How a teacher perceives their own abilities in teaching with technology may have a great effect on whether a teacher decides for students to use ICT.

Another theme that immerged in the review of research for personal factors in K-5 teacher decision-making was time. Teachers felt that time constraints were a factor that influenced their decision for student use or not to use ICT. For example, in a study by Alenezi (2017), after interviewing elementary school teachers, identified time as a significant factor that influenced a teachers' decision to not use ICT.

Summary and Conclusions

Data from study results in the last 5 years show that a teacher's perception of student ICT use influences their decision to have students use ICT and also at which level of the SAMR model they can do so. The gap that remains is a diminutive understanding about the decision-making process of K-5 teachers as it relates to student use of ICT. This gap is important to address because researchers and educators may be provided with increased understanding of the decision-making process of teachers who choose to use ICT for students. Information that may in turn encourage stakeholders such as central administrators, campus administrators, instructional coordinators, and coaches to use the findings from this study to better understand the factors that influence teacher technology implementation decisions, so districts can foster environments in which teachers are more likely to implement technology with young students.

While some studies included examples of how ICT was used by students which can be correlated with the ISTE Student Standards (2016, p. 1) for K-5 students (Angeli et al., 2016; Kearney et al., 2015; Malecki, 2018; Ruggiero & Mong, 2015; Žufić et al., 2017), the research on technology literacy has primarily focused on secondary, higher education, and among pre service educators, with little research on skills building K-5 digital literacy skills, nor framing research within the scope of the ISTE student standards. In addition, other studies included examples of factors influencing K-5 teacher decision-making in the context of Gu et al. (2013) TAM (Alenezi, 2017; Ghavifekr & Rosdy, 2015; Tosuntaş et al., 2015; Liu & Pange, 2015; van Deursen et al., 2016), despite the fact that there is not a wealth of research surrounding K-5 teacher decision-making to

have students use ICT based on personal factors. Other studies included evidence of how teachers have K-5 students use technology in the classroom in the context of Puentedura's (2006) the SAMR model (Amr et al., 2016; Aubusson et al., 2014; Bartha et al., 2016; Share, 2015; Ylizarde & Shockley, 2018;), even though there are few examples where elementary students are included.

I explored the phenomenon of the decision-making process of K-5 elementary teachers regarding implementation of ICT for student use. I will expand on current research by exploring the decision-making process of elementary K-5 teachers to have student use ICT using generic qualitative inquiry methodology, which includes the use of research methods such as interview and observation. Data from my study may improve understanding by adding deeper insight into what influences the decision-making of teachers implement ICT with students and contribute to what is understood related to how teachers have K-5 students use technology, as well as the teacher decision-making process that accompanies that use so that teachers may be better supported during throughout this process.

In Chapter 3, I provide descriptions about the research design and rationale, role of the researcher, methodology, evidence of trustworthiness, and ethical procedures. Chapter 3 includes detailed information about how the chosen research design is best suited for exploring teacher decision-making. I also provide a detailed process for recruiting participants, obtaining data, and analyzing data. Great care was be taken to uphold trustworthiness by addressing credibility, transferability, dependability, and confirmability. Ethical procedures are carefully considered and disclosed in this chapter.

Chapter 3: Research Method

Introduction

The purpose of this study was to explore the decision-making process of K-5 teachers regarding implementation of ICT for student use at varying levels. In order to explore teachers' decision-making process, I used semistructured, individual interviews. The conceptual framework of this study included the use of two models, Puentedura's (2006) the SAMR model and the TAM by Gu et al. (2013), as lenses through which to interpret the data collected. Chapter 3 includes topics such as the research method used in this study. In this chapter, I also describe the research design and rationale as well as the role of the researcher. Furthermore, I discuss the methodology as it relates to participants, instrumentation, and the data collection and data analysis plans. In addition, issues of trustworthiness and any ethical considerations connected to this qualitative research study are addressed.

Research Design and Rationale

In this section, I expound on the research questions that guided this qualitative study, describe the central phenomenon, and provide a rationale for the chosen methodology of this study. The central research question and research questions focused on a K-5 teachers' decision-making to have students use ICT and were aligned with the conceptual framework and the literature review for this study:

Central Research Question: How do K-5 teachers describe their decision-making process to implement student use of ICT?

Research question 1: How do K-5 teachers have students use ICT in the classroom?

Research question 2: What influences teacher decisions to have students use technology?

Research question 3: How does the decision-making process compare among K-5 teachers who use technology with students at varying levels of implementation?

Rationale for Research Design

The research design I employed in this study was a generic qualitative design. The design offers several important considerations that suited the nature of this study. Percy et al. (2015) defined the generic qualitative design as research that investigates participants' personal accounts, including opinions, attitudes, beliefs, or reflections, in their own experience of events in the world. Percy et al. recommended that a generic qualitative design be used especially when the research problem requires a qualitative methodology where others are inappropriate and when the researcher has prior knowledge or experience about the topic that they want to describe more fully from the perspective of the participant.

Although the term *generic research design* is accepted among many authorities in qualitative research, disagreements do exist as to the nomenclature used. For example, Merriam and Tisdell (2016) specifically discouraged the use of the term generic research design due to the lack of specificity characterized by the term. Patton (2015) asserted that generic qualitative inquiry is an appropriate term for the research design due the accepted

fact that not all forms of inquiry need a formal conceptualization within one of the specific traditional methods of inquiry. The differences among researchers concerning the term generic versus basic research design ultimately lie in semantical preferences and not in the validity of the research design itself.

Considerations for Other Designs

While in the proposal stage, I considered other research designs for use in this study, which included case study, phenomenology, grounded theory, and ethnography. Ultimately, generic qualitative design was determined to be the most appropriate approach for this study. In the following paragraphs, I provide the defining characteristics of the other designs and the reasons why they were not viable options for this study.

Ethnography is a research design whereby a phenomenon is studied in relation to bounded units over a prolonged period of time while immersed in a cultural group (Burkholder, Cox, & Crawford, 2016). Ethnography focuses on the investigation of the network of social groupings, customs, beliefs, behaviors, and practices that define a culture (Burkholder et al., 2016). According to Creswell and Creswell (2017), ethnography necessitates the existence of a cultural-sharing group for a period long enough to have established patterns of ideas and beliefs. To examine the phenomenon of this study, I did not have a prolonged immersion in cultural groups and was not focused on values, behaviors, or rituals that may be established by a smaller group of people.

Case study, defined by Burkholder et al. (2016), is used to examine or describe the interactions of a unit bounded in some form and its relation to a phenomenon. Case studies are in-depth investigations of a single case using several methods and multiple

sources of data (Burkholder et al., 2016). A single case is defined by having clearly recognizable boundaries that differentiate the case from any other set of instances (Burkholder et al., 2016). There is disagreement among researchers concerning the most noteworthy characteristics of case study design, but two were most prominent. Yin (2013) suggested that the process was the most important feature of case study, while Merriam and Tisdell (2016) posited that the bounded unit is the identifying feature of case study. This study was not limited by boundaries, such as time and place, or by a rigid process; therefore, a case study was not the optimal choice for a research design.

Grounded theory is defined by Burkholder et al. (2016) as a research design that can describe phenomena occurring in the world that leads to complex understanding and can eventually lead toward building theories. Merriam (2001) described the purpose of grounded theory as a design used to build substantive understanding and a theory about the phenomenon of interest. Grounded theory uses data from people to develop an explanation for the process in question developed over time (Merriam, 2001). The central research question in this study did not lend itself to the development of a theory but is descriptive in nature and not explanatory.

Burkholder et al. (2016) defined phenomenology as a research design that enables a researcher to understand the life experiences of a set of individuals who share a common experience. Creswell and Creswell (2017) described the purpose of phenomenology as the intention to describe the lived experience of individual in relation to a particular phenomenon. Many of the phenomena this approach addresses include attitudes, beliefs, opinions, and feelings (Creswell and Creswell, 2017). A study that uses

phenomenology is focused on the deeper dimensions, textures, qualities, and structures of cognitive processes and not in the external content or environment that may play a part in the cognitive process, which is what I sought to understand in this study.

Role of the Researcher

In this qualitative study, I served as the primary investigator and observer. This role involved collecting data and subsequently analysis them as well as planning and facilitating the research design for the study, participant selection, determining sources of data, and creating tools for collecting data. As the primary investigator, I was also responsible for developing the procedures for recruiting participants, collecting and analyzing data, and using strategies that strengthened the trustworthiness of this qualitative research. My role as researcher did not conflict with my present position as district digital learning coach because I did not recruit or select participants with whom I work at any level or capacity with in the district I am currently employed by. Therefore, I had no supervisory or coaching responsibilities for the participants being recruited.

Methodology

In this section, I provide detailed descriptions about how the research was conducted. The methodology section includes specific details about how data was collected. This section specifically includes participant selection logic; procedures for recruitment, participation, and data collection; instrumentation; interview guides; procedures for recruitment, participation, and data collection; data analysis plan; credibility; transferability; dependability; and confirmability.

Participant Selection Logic

Participants for this study included highly qualified, public-school teachers who taught kindergarten through fifth grade and had students with access to ICT for educational use from at least 10 campuses in the district. Participants came from a district that serviced 20,000 students and 23 campuses. The district was predominantly comprised of high-poverty campuses that service low socio-economic families whose students are high need and considered at-risk for failure or dropping out of school. According to the National Center for Education Statistics (2018), high-poverty schools are those that meet the requirement that at least 75.0% of the enrolled student population are eligible for the Free and Reduced Prices Lunch Program.

I used purposeful sampling to select participants for this study. Creswell and Creswell (2017) suggested that purposefully selecting participants is ideal for qualitative research in an effort to help the researcher better understand the problem and address research question. Furthermore, Ravitch and Carl (2015) suggested that purposeful sampling is the primary method used in qualitative research. Ravitch and Carl defined purposeful sampling as a process of participant selection where they are purposefully selected for a specific reason that falls well inside the context established by the research questions. Justification for this sampling method includes a reason that participants may have certain experience or knowledge of the phenomenon. Patton (2015) suggested that purposeful sampling is ideal when certain participants might have insight and "offer useful manifestations of the phenomenon of interest" (p. 46). Francis et al. (2010) suggested that the ideal number of participants is 10 to 12. I followed this suggestion for

K-5 teacher participants as the initial analysis sample but that could have changed if deemed necessary after initial analysis. A stopping criterion is applied that helps to determine if more interviews are needed (Francis et al., 2010). According to Francis et al., the stopping point, which coincides with the saturation point of data, happens when qualitative data become repetitive and redundant with no new emergent themes. Furthermore, Sim, Saunders, Waterfield, and Kingstone (2018) concluded that defining sample size a priori is problematic; however, they offered the insight that this content-dependent, iterative process is subject to the interpretation of the researcher because the relationship among the emergent themes appears throughout the analytical process.

I selected participants according to specific inclusion criteria. Teachers had to meet the following inclusion criteria at the time of recruitment: (a) be a kindergarten through fifth grade teacher, (b) teach in a K-5 elementary public school, and (c) and have their students use ICT and smart devices for educational activities.

Instrumentation

For this study, I gathered data in two rounds of semistructured interviews. I developed interview guides as my instrument for data collection. The interview questions were aligned with the research questions, and I asked an expert panel of two of my colleagues with advanced degrees in education to review the alignment of these instruments to the research questions. Using the assistance of these colleagues added validity to the goal of the interview questions generating the information needed to address the research questions.

The two rounds of semistructured interviews included questions that were aligned with the conceptual framework and research questions of this study. After analyzing the data from the interviews, I conducted a second round of coding to ensure reliability and triangulation. The semistructured interview questions were designed to provide me with sufficient data with which to answer the research questions.

Interview guides. The interview guides were based on research that Merriam (2001) presented in relation to conducting effective interviews for qualitative research. Table 2 is an alignment of the six teacher interview questions to the research questions for this study. Table 3 is an alignment with the second round of interview questions. The interview questions in Tables 2 and 3 are tightly aligned to the research questions. For instance, Interview Questions 1 through 3 specifically address Research Question 1, which is an attempt to ascertain how teachers have students used ICT in the classroom, and were designed to elicit data that falls into one of the categories of the SAMR model technology use. Research Question 2, developed to determine the influences on teacher decision-making to have students use technology, is addressed by Interview Questions 4 through 8. These questions were designed to elicit data that fell into the TAM constructs like outcome expectancy or TTF. In the second round of interviews, Research Question 3, focused on comparing the decision-making among K-5 teachers who use technology with students at varying levels of implementation, was addressed by all of the four of the interview questions in Table 3 and specifically aligned with the SAMR model levels of technology use.

Table 2

Round 1 Interview Questions for K-5 Teachers

Interview Questions	RRQ1	RRQ2	RRQ3	CRQ
IQ #1: When your students use technology, what technologies do they use? (Hardware/software)	X			X
IQ #2: Describe a classroom activity you've had students do, where they get to use technology.	X			X
IQ #3: Using a Chromebook/handheld would you please show me a technology you've had students use and walk me through, how students use it?	X			X
IQ #4: What influenced your motivation to have students do activities that include technology-use?		X		X
IQ #5: In your experience, what all do you have to consider, before you decide to introduce a technology for students to use?		X		X
IQ #6: What activities if any, would you like to have your students be able to do, using technology in the upcoming year?		X		X
IQ #7: As you decide to use technology in an activity, how much does technology literacy play a part in your decision? For example, online safety, media smarts, digital citizenship.		X		X

Table 3

Round 2 Interview Questions

Interview Questions	RRQ1	RRQ2	RRQ3	CRQ
Round 2 IQ #1: How important is confidence in your own ability to use a new technology, before introducing it to your students to use?			X	X
Round 2 IQ #2: How does your perception of a technology improving students' ability to accomplish a goal, influence your decision on whether or not to use it?			X	X
Round 2 IQ #3: How much do your colleagues or other professionals influence your decision to have your students use technology?			X	X
Round 3 IQ #4: How much does the ease of use in technology influence your decision to have students use it?			X	X

Procedures for Recruitment, Participation, and Data Collection

In relation to recruitment, I first contacted the deputy academic officer (DAO) to explain the purpose of my study and to request permission to approach principals regarding recruiting participants from the school district. I obtained a letter of cooperation from the DAO to submit during the internal review board (IRB) approval process. With Walden IRB approval, I contacted the campus principals to notify that I was in contact, via e-mail, with the digital learning coaches that serve their building to assist with recruiting participants. I did not contact the principals from any campuses that I am affiliated with. Once I obtained the contact information of the digital learning coaches that service the campuses I have contacted, I reached out via email to request the names of potential teachers who may participate in the study. The first 12 teachers who responded were selected to participate in the study.

Recruitment of participants happened with the assistance of digital learning coaches. I sent e-mails to the digital learning coaches that service the campuses in which I had approval, to request the names of potential teachers who fit my inclusion criteria. Digital learning coaches are instructional coaches who work with teachers and support educational technology integration through coaching cycle. Once I received a list of potential participants, I e-mailed each with an invitation to participate. The invitation included information about the study. Teachers who were willing to be part of the study were asked to fill out an online survey with demographic information. Several studies indicate an initial participant pool of 10 for qualitative research using interviews to collect data and suggest that careful consideration of saturation guide the number of participants (Francis et al., 2010; Guest, Bunce, & Johnson, 2006; Mason, 2010). I included the first 12 teachers that filled out the survey to be a part of the study. The participants were engaged in a first round of interviews and responded to interview questions pertaining to their perception of the influences on decision-making for students to use ICT, and the various ways that students use ICT in the classroom. I used the first round of interviews to determine where on the SAMR model each teacher has students use technology. Then, I purposefully sampled four teachers from my original 12 who have students use ICT at various levels in the SAMR model and invited them to participate in a second round of interviews.

Concerning participation, all K-5 teachers who have access to technology for their students to use were eligible to participate, but I only reached out to the first 12 of all those that were recommended to me by the digital learning coaches who service their

respective campuses. Participants were invited to be part of face to face interviews which did not last longer than 45 minutes for the first round, and possibly invited to participate in the second round lasting no longer than 20 minutes. After they participated in the interviews, they were asked to review transcripts of the interviews which did not take longer than 15 minutes. I then selected the first 12 teachers who returned consent forms to participate. Part of participation in this study included member checking. Once I completed transcribing the interview, I sent the file via e-mail to the participants and provided directions for them to review the content and identify any discrepancies they found in what they said, and what they meant. I used their input to address and correct the transcripts. Some of the participants in the first round of interview were invited back to participate in a second round. These teachers were contacted again by e-mail to schedule a follow up interview. Teachers were asked to verify the transcription of this round in a member-checking process as well. I also sent an exit e-mail to everyone at the same time after the second round of interviews informing them that the process had ended and thanked them for their participation.

The only source of data in this study came in the form of interviews with K-5 teachers who have students use ICT. Each round of semistructured interviews lasted between 30 and 45 minutes. I record interviews using a Sony ICDUX560BLK Digital Voice Recorder. Initial recruitment did not result in too few participants; therefore, another e-mail was not sent to instructional coaches to recruit more participants.

Data Analysis Plan

For this generic qualitative study, I conducted data analysis in the steps suggested by Rubin and Rubin (2011). The first step is transcription and summarization of each interview, followed by coding excerpts with relevant concepts, themes and events (Rubin and Rubin). After that, the process for finding excerpts with the same code from all interviews is done any number of ways (Rubin and Rubin). The codes are sorted and resorted, them summarized into results, where the researcher weighs different versions and integrates descriptions, combined with concepts and themes, and evaluates generalizability beyond individual cases (Rubin and Rubin).

More specifically, I included the use of a priori codes, codes that are determined beforehand permissible in qualitative research based on what the researcher anticipates hearing in the interview and seeing in the data (Burkholder et al., 2016; Saldaña, 2015). The use of a priori codes "set beforehand can be categorized and made consistent within categories" (Elliott, 2018, p. 2855). A priori coding is appropriate and well aligned with the research design, generic qualitative methodology, especially since the researcher has knowledge and practical experience with the phenomenon which is the case for this study (Elliott, 2018). I developed the a priori codes for this study, aligned to the constructs of my framework. These a priori codes were organized in a codebook that I used throughout the data analysis process. See Appendix A and B. A priori codes were developed to align to the SAMR model and TAM. These codes were aligned not only with research from the framework authors but were also verified through the literature review. I used the a priori codes in the level one coding of interview data in order to find text excerpts that are

combined according to the a priori codes, aligned to my framework. Then, in level two of coding I searched for common themes to emerge within the categories. Throughout this process I used Microsoft Office Word and Excel to organize my coding process.

Part of the data analysis plan is knowing how to treat discrepant data. Discrepant data are data that challenges or disconfirms what a researcher might anticipate finding among the data yielded from various sources (Bashir, Afzal, & Azeem, 2008; Merriam & Tisdell, 2016). It is important to identify discrepant data because reliability and validity are directly affected when researchers are not transparent when it comes to omissions in reporting data, even data that may be contrary or outside established themes (Merriam & Tisdell, 2016; Patton, 2015). My plan for dealing with discrepant data included transparency, and due equitable attention in reporting any data that may fall outside established themes. Merriam and Tisdell (2016) suggested that seeking discrepant data is actually desirable in research so that researchers can achieve the highest degree of trustworthiness in their research.

Evidence of Trustworthiness

Trustworthiness is important to qualitative research because of ethical considerations in working with the perceptions of others and being trusted to make an accurate and unbiased contribution to the body of knowledge that currently exists. Research ethics have far-reaching implications based on the decisions made before, during and after working with participants in a study (Burkholder et al., 2016). When working with human subjects there are ethical protocols in place that protect them, and the trust afforded to the researcher in the form of confidentiality. Ethical codes,

regulations, and principles are in place, which are strictly adhered to in this study, such as respect for persons, beneficence, and justice (Burkholder et al., 2016). In this study, I ensured that voluntary participants are well informed before consent, during the study, and after. For instance, Burkholder et al. (2016), provided suggested components to better ensure informed consent such as:

- Explain the purpose of the research.
- State the expected length of participation in the study.
- Outline what the participant will do.
- Describe potential benefits and risks associated with participation.
- Make sure participant is aware that they can discontinue participation at any time.
- Provide details of how confidentiality will be maintained.

Ethical issues also arise when producing and sharing the findings of the study. Stakeholders have a vested interest in the results due to the potential impact on policy and procedure (Patton, 2015). In the following subsections I describe how trustworthiness is reinforced by the constructs of credibility, transferability, dependability, and confirmability.

Credibility

For qualitative research, Merriam and Tisdell (2016) defined credibility as the question of research findings being congruent with reality. Merriam and Tisdell also recommended that qualitative researchers use the following strategies to improve the credibility of qualitative research: (a) triangulation of data from several sources, (b)

member checking or respondent validation, (c) adequate engagement in data collection, (d) seeking out discrepant data, and lastly (e) peer review. Houghton, Casey, Shaw, and Murphy (2013) suggested that researchers approach rigor in a study by using strategies to strengthen credibility. Two such strategies are triangulation and member checking. Therefore, I established credibility in the form of internal validity by triangulating the in-depth interview data and member checking. Researchers achieve greater credibility through triangulation, which is the process of member checking which involves allowing participants to review the transcription of their interview to better ensure accuracy in the recorded information thereby ensuring greater credibility (Carlson, 2010; Houghton et al., 2013). The transcripts were reviewed and confirmed by participants, correctly reflect their perceptions and experiences as they engage in decision-making to have their students use ICT in classroom educational activities. According to Thurmond (2001) there are five methods to achieve triangulation Thurmond wrote that time, space, and people are the three sources of data and that data source triangulation can increase confidence in the research data and that a researcher can triangulate by data sources, investigator, method, theory, or data-analysis. Data source triangulation is the combination of two or more data sources and in this study, I employed the use of two rounds of interviews, which is using the separation of time, as a triangulation strategy. Theoretical triangulation occurs when a researcher uses multiple theories or hypotheses when examining a phenomenon. Since I used the SAMR model, and the TAM, this qualifies as theoretical triangulation. Since I was the only investigator, and investigator triangulation requires multiple investigators, this strategy is inappropriate. Method

triangulation is used in mixed-method studies, and this study only included the use of a qualitative research approach; therefore, this strategy of triangulation is not appropriate. Data-analysis triangulation is the use of two or more methods to analyze data. I only used thematic coding from interview data.

Transferability

Merriam and Tisdell (2016) defined transferability as "the extent to which the findings of one study can be applied to other situations" (p. 253). I address transferability by indicating how the findings of this study on the decision-making of K-5 teachers to have their students use ICT in a classroom educational activity could be applied to another similar situation using the deep and rich descriptions of contextual information that includes the size, location, population, and demographics of the school district needed to enable a transfer by providing rich, thick descriptions of the setting, participants, and findings of the study (Merriam & Tisdell, 2016). Using a purposive sampling strategy can aide in supporting the transferability of the research findings to other studies.

Dependability

According to Merriam and Tisdell (2016) reliability, is "the extent to which research findings can be replicated" (p. 250). Furthermore, Merriam and Tisdell provided a suggestion that dependability in qualitative research is strengthened when consistent methods of data collection instruments are used across participants and settings. I upheld dependability by recording my thoughts and actions in meticulous documentation of all process involved throughout this study in a reflective journal. Slotnick and Janesick

(2011) surmised that there is an advantage in a researcher using a reflective journal. Thorough analysis and reflection over all processes and procedures is prudent and can be achieved more readily through a research reflection journal. Furthermore, the research reflective journal can be beneficial as a critical, rigorous, and systemic tool for additional analysis. The journal can provide a researcher with an additional layer of accountability for themselves, and for the participants by uncovering meaning in word and deed, that which is spoken and unspoken in the interview with side notations throughout the research process and interview (Slotnick & Janesick, 2011). When researchers use reflective journals the level of interest and engagement in the research process is increased (Orange, 2016). Furthermore, empirical research has shown that researcher reflection journals increase attentiveness in data collection, data analysis, and in the overall research process (Orange, 2016). I anticipate that this attention to detail will enable future researchers to replicate this study in the same context, using the same methods and participants in an attempt to obtain similar results. Documentation includes information and description of the research design specifications, research questions, interview questions, the interview protocol, tools and a reflective review.

Confirmability

According to Shenton (2004), confirmability is the ability of other researchers to trace and review the course of a study, step-by-step throughout the entire process. The issue of confirmability, tantamount to objectivity, can be defined as an attempt to maintain the integrity of reporting all actions taken in a study and in addition, disclosure of any potential bias. I ensured confirmability by disclosing my own predispositions,

specifically my beliefs which may underpin the decisions I made and the methods that I adopt throughout the research report. Shenton suggested “ongoing reflective commentary” which is included in a researcher reflective journal and within the research report (p. 72).

Ethical Procedures

The trustworthiness of qualitative research depends on how researchers follows ethical procedures. According to Patton (2015), “the trustworthiness of the data is tied directly to the trustworthiness of those who collect and analyze the data- and their demonstrated competence” (p. 706). Merriam and Tisdell (2016) reinforceed this notion and adds that the credibility of a study rests squarely on the “training, experience and intellectual rigor” of the researcher who is conducting the research (p. 260). Ultimately the responsibility for producing a study that has been carried out and reported in an ethical manner rests upon the individual researcher (Merriam & Tisdell, 2016).

For this study, I followed ethical procedures by applying to the IRB at Walden University. The IRB approval number for this study is 05-13-19-0198559. Initially, I addressed the ethical concern of data collection. Each step for data collection is articulated in the method section. Confidentiality was ensured by excluding identifying personal information. Any data collected was stored on a personal password protected external hard drive for at least 5 years after the study has been published. I ensured confidentiality by meeting in a time and place outside the school day that is befitting the participants. The name of the district or the campus where the teachers work was not disclosed or referenced. I developed a plan for sharing the results of my study with

participants and community stakeholders. To the best of my knowledge, the risks associated with participating in this study were minimized as much as possible. I have weighed the risks and burdens in consideration of the new knowledge that this research can offer and agree that the benefit outweighs the potential risks. I obtained a letter of cooperation from the district who agreed to grant me permission to access, and to invite teachers to be participants in my study.

Other ethical issues relate to the issue of participant recruitment. Participant recruitment was coordinated in a manner that is not coercive. District technology coaches are my colleagues and acted as gate keepers providing me with names and email addresses. I did not seek or accept participants who are categorized as a vulnerable individual. If an individual had been included without my knowledge and it is brought to my attention, they would have been given the options to participate. It would be left to the individual whether they continue as a participant or decided to exit the study. I would have excluded their contribution with respect and without stigma. The research design ensures that all participants can potentially benefit equally from the research.

Informed consent for participants was another important ethical issue related to my study. I ensured that participants had adequate time to review the study information and ask questions before giving consent. The consent was documented, and understandable language was used. The consent form outlined the criteria which made the participant eligible to participate and the purpose of the study was made known. The consent form included an outline of the data collection procedures and an approximation of how long the interview lasted. The consent form made the participant aware that

participation is voluntary and has the right to decline or discontinue participation at any time. The consent form included a description of reasonably foreseeable risks as well as the benefits. The consent form included a disclosure that there was no compensation or reimbursement for time or travel. The consent form included all potential conflicts of interest, and an assurance that the researcher preserved the participant's legal rights with contact information to the university research participant advocate.

The last issue of ethics relates to the protection of confidential data. Interviews took place and were recorded using a digital recording device. Each recording was only saved in two locations. One location was the hard drive of my password protected home computer and also uploaded to an external independent, encrypted, password-protected, hard drive where interviews were transcribed into a Microsoft Office Word document. All files were be kept in a password-protected external hard drive. All interviewees were assigned a random pseudonym. No names, locations, or identifying characteristics were referenced directly or indirectly at any point in the research process. Only I had access to this data. Once the data analysis was complete, the participant was invited to engage in a member-checking process to verify accuracy of the transcription and subsequent analysis. The data will be kept for 5 years after the completion of the study, and then destroyed.

Summary

This chapter included detailed descriptions of the research method which includes research design and rationale, role of the researcher, methodology, evidence of trustworthiness, and ethical procedures for this study. The research design is a generic qualitative study. Other designs were rejected due to a lack of appropriateness to

investigate the phenomenon and address the research questions. The section titled Role of the Researcher outlined my involvement in this study as a collector and analyst of data once procedures are enacted to recruit and interview participants. The methodology section outlined participant selection criteria and strategy which is purposeful selection. This section also includes the interview guide which contains the interview questions in relation to the research questions. Evidence of trustworthiness was described and supported by addressing such constructs as credibility, transferability, dependability, and confirmability. Ethical procedures expounded upon the precautions and safeguards that were be taken to protect the participant, the integrity of the data, its interpretation, and its subsequent reporting.

In Chapter 4, I provided specific information about the results of this study and the context in which they were ascertained. Details concerning the setting where the study took place, demographic data pertaining to the participants, methods used for data collection and analysis, evidence of trustworthiness, and finally the results. Chapter 4 includes the use of extensive frequency tables for increased ease in referencing patterns among the data.

Chapter 4: Results

Introduction

The purpose of this qualitative study was to explore the decision-making process of K-5 teachers regarding implementation of ICT for student use at varying levels. To accomplish this purpose, I used a generic qualitative research design that was well aligned to address the central research question and research questions.

Central Research Question: How do K-5 teachers describe their decision-making process to implement student use of ICT?

Research question 1: How do K-5 teachers have students use ICT in the classroom?

Research question 2: What influences teacher decisions to have students use technology?

Research question 3: How does the decision-making process compare among K-5 teachers who use technology with students at varying levels of implementation?

In this chapter, I report the results of this generic qualitative study. The data may have been influenced by district initiatives, such as the integration of software programs like RazKids, DreamBox, and Education Galaxy for language and math literacy and fluency that were adopted in the 2018–2019 school year. The chapter includes the setting, demographics, data collection, Level 1 data analysis, Level 2 data analysis, evidence of trustworthiness, results, and the summary.

Setting

The research site for this generic qualitative study was a public school district located in the South-Central United States. This school district contains 14 elementary campuses, six middle school campuses, and four high schools. District demographics indicated that based on a student population comprised of approximately 20,000 K-12 students, the majority of campuses are eligible to receive Title I funding indicating that there is a large number of high-poverty campuses that service low socio-economic families whose students are high need and considered at-risk for failure or dropping out of school.

Several organizational conditions may have influenced my interpretation of study results. For example, the district initiated a digital learning program 5 years ago where digital learning coaches were hired to train teachers in the proper use of educational technology throughout the district. Recently, a technology bond was passed that allowed the district to purchase an iPad for every teacher in the district as well as integrate an update to the network that improved the speed and fidelity of Internet access for all district employees.

Demographics

The participants for this study included 12 teachers in Grades K-5 at five different campuses. The age and experience of the teachers ranged from 30 to 59 years old and 5 to 27 years of experience as a classroom teacher. Two of the participants were male, and the other 10 were female. Three teachers taught in kindergarten, one in Grade 1, one in Grade 2, one in Grade 3, two in Grade 4, and four in Grade 5. Each teacher participated in a

semistructured interview comprised of eight questions focused on how students use ICT for learning. Four out of the 12 teachers returned to participate in a second round of interviews to answer questions focused solely on factors that influence their decision-making. I selected these participants based on the demographic information provided in the initial survey they filled out and the information they provided in the first interview. Table 4 shows participant demographics.

Table 4

Participant Demographics of Experience, Gender, and Current Position

Participant Pseudonym	Teaching Experience in years	Gender	Current Position	Frequency of student technology use
January*	13	Male	Grade 5	Daily
February*	18	Female	Grade 4	Daily
March	27	Female	Kindergarten	Daily
April	11	Female	Grade K-5	Daily
May	10	Female	Grade 4	Daily
June	20	Female	Grade 5	Daily
July	9	Female	Grade 1	4-5 times weekly
August	23	Female	Grade 2	Daily
September	17	Female	Grade 5	4-5 times weekly
October*	5	Female	Grade 3	Daily
November	19	Female	Kindergarten	2-3 times weekly
December*	16	Male	Kindergarten	Daily

Note: * Indicates teachers who were interviewed in the second round

Mr. January was a teacher in Grade 5 with 13 years of classroom teaching experience in both elementary and middle school (see Table 4). He was assigned to teach English language arts and social studies. In the demographic survey, he reported that his students use technology such as Chromebooks, iPads, and VR headsets daily and characterize their use in activities that are not possible without technology. Mr. January was invited to participate in the second round of interviews, and he accepted my invitation.

Mrs. February was a teacher in Grade 4 with 18 years of classroom teaching experience in elementary school. She was assigned to teach all content areas. In the demographic survey and in the interview, she mentioned that her students typically use ICT daily, which included a class set of Chromebooks and web-based software. Mrs. February enjoys providing her students the opportunity and the option to use technology. She applied for a grant and obtained a class set of Chromebooks so that her students could have access every day throughout the school year. She was happy to provide examples of her students using technology in her class and thoughtful perceptions of factors that affect her decision-making when it comes to her students using ICT. Mrs. February was invited to participate in the second round of interviews, and she agreed.

Mrs. March was a kindergarten teacher for 27 years (see Table 4). Her responses from the demographic survey revealed that her students used technology on a daily basis. For example, students used hardware including iPads; computer lab personal computers; and software, such as Lexia for literacy remediation, DreamBox for math skills and numeracy improvement, Seesaw for parent communication and learning activities, and ABC Mouse for online educational games.

Mrs. April was a K-5 teacher of computer applications in an elementary school. She taught all students on the campus. In the demographic survey form, her responses indicated that her students use technology in activities characterized by a functional improvement and creation that is not possible without technology on a daily basis. Her students mainly use student personal computers with a variety of software, including Google Apps for Education, Tinkercad, RazKids, and DreamBox. Mrs. April was a

unique participant in that she is a technology teacher who is assigned to teach students how to use ICT.

Mrs. May was a teacher in Grade 4 with 10 years of classroom teaching experience (see Table 4). She reported in the demographic survey that her students use technology on a daily basis, including the use of Chromebooks and iPads with software, such as DreamBox, Razkids, and Seesaw learning activities. In her response to the question about how she would characterize the ways that students used the technology, her reply was that they typically use it for activities that can be substituted for paper and pencil as well as activities that allow for a functional improvement when using technology. Mrs. May wanted to participate in the interview process in her room. During the interview, she demonstrated the technology stations and explained how she integrated ICT into her lessons.

Mrs. June was a teacher in Grade 5 with 20 years of teaching experience (see Table 4). Her students used technology daily, including activities with ChromeBooks, iPads, Google Apps for Education, Dreambox, Razkids, and a variety of other web-based software programs. In her demographic survey responses, she characterized her students' use of technology as a substitute for paper and pencil as well as use for creation that is not possible without technology.

Mrs. July was a teacher in Grade 1 with 9 years of teaching experience (see Table 4). Her students used technology, including devices such as Chromebooks and personal computers, four to five times a week. Her students used Google Apps for Education, Razkids for skill building in reading and math, as well as a variety of other web-based

software programs. She characterized her students' use of technology as a substitution as well as having a functional improvement in learning activities when technology was used.

Mrs. August was a teacher in Grade 2 with 23 years of teaching experience (see Table 4). In the demographic survey, she responded that her students used technology daily and characterized the use of technology to allow for a task to be substituted; to have a functional improvement; and to be redesigned when using technology. Her students had regular access to hardware such as Chromebooks, iPads, personal computers, and MacBooks. Students used software such as Google Apps for Education, DreamBox, Accelerated Reader, and Education Galaxy.

Mrs. September was a teacher in Grade 5 with 17 years of classroom teaching experience (see Table 4). Based on the responses given in the demographic survey form she submitted, her students used technology in the range of four to five times a week at various levels, such as substitution and redefinition. Her students manly used MacBooks and Google Apps for Education with DreamBox.

Mrs. October was a teacher in Grade 3 with 5 years of teaching experience (see Table 4). The responses in the demographic survey indicated that her students used technology on a daily basis. They had access to a class set of Chrome Books and mainly worked in Google Apps for Education. She used Google Classroom to house her assignments for students to access and complete. The responses in her interview and the survey indicated that her students mainly use technology at the redefinition level of the

SAMR model. Mrs. October was invited to participate in the second round of interviews, and she agreed to do so.

Mrs. November was a kindergarten teacher with 19 years of teaching experience (see Table 4). She reported that her students use technology in the range of two to three times per week. They have access to iPads and two classroom personal computers. Her students mainly use DreamBox, ABC Mouse, and SeeSaw learning activities. She also reported that her students typically use technology for skill building in reading and math.

Mr. December was a kindergarten teacher with 16 years of teaching experience (see Table 4). He expressed some trepidation about participating because he felt that his students only use technology for activities that he described as low levels of rigor, which included DreamBox and ABC Mouse on Chromebooks and student personal computers in the classroom. Once the interview began, he was comfortable with describing his perceptions about factors that affect his decision-making and how his students use ICT. Both the interview and survey information confirmed that students in his class have daily access to technology and use it mainly for skill improvement in reading and math. Mr. December was also invited to participate in the second round of interviews, and he agreed to do so.

Data Collection

For this generic qualitative study, I collected data from one source. Two separate rounds of interviews were scheduled; the first round for all 12 participants, then with only four participants in the second round. In the second round of interviews, teachers were purposefully sampled based on the demographic information they provided and the

answers to the questions posed in the first round. My intent was to invite a participant who had students use technology at each level of the SAMR model based on interview data; however, due to time constraints, I had to purposefully select potential second round interviewees based on the responses collected from the demographic survey. The second round of questions pertained specifically to factors that influence their decision-making about implementing student use of technology.

After all interviews were complete, I transcribed and coded all the interview data using a priori coding applying methodological processes recommended by Burkholder et al. (2016) and Saldaña (2015). Four a priori codes were developed aligned to the SAMR model, and an additional four were developed aligned to the TAM, both comprising the conceptual framework of the study (see Appendix A).

Interviews

On May 13, 2019, I received approval from IRB to conduct this study. I began recruitment immediately, hoping to catch teachers before the end of the school year. Interviews started in May 21, 2019. There were no variations in the data collection process described in Chapter 3. I audio recorded all interviews using a Sony digital audio recorder and an Apple MacBook. The recordings were saved on a secure, encrypted, and password-protected external hard drive. I conducted the first interview with Mr. January on May 21 at 8:00 a.m. in the teacher's classroom. This interview lasted 40 minutes. My next interview was with Mrs. February on May 21 at 12 p.m. in the teacher's room. This interview lasted 25 minutes. My interview with Mrs. March took place on May 21 at 12:35 p.m. in the teacher's room and lasted 35 minutes. The next interview was with Mrs.

April on May 22 at 1 p.m. in the teacher's room. This interview lasted 40 minutes. Mrs. May was the next interviewee and her interview took place on May 22 at 2 p.m. in the teacher's room and lasted 30 minutes. Mrs. June's interview took place on May 22 at 4:30 p.m. in the teacher's room. The duration of this interview was 30 minutes. My next interview was with Mrs. July on May 23 at 1 p.m. in the teacher's room. This interview lasted 35 minutes. A second-round interview with Mr. January took place on May 28 at 12 p.m. in the teacher's room and lasted 20 minutes. The next interview was with Mrs. August on May 28 at 3 p.m. in the teacher's room. This interview lasted 40 minutes. Mrs. September was next, and she was interviewed on May 29 at 10 a.m. in the teacher's room with the interview lasting 40 minutes. Mrs. October's interview took place on May 29 at 12 p.m. in the teacher's room. The duration of this interview was 25 minutes. My next interview was with Mrs. November on May 29 at 3 p.m. in the teacher's room. This interview lasted 40 minutes. The second-round interview with Mrs. February occurred on May 30 at 3 p.m. in the teacher's room and lasted for 20 minutes. My final first-round interview was with Mr. December on May 31 at 12 p.m. in the teacher's room. This interview lasted 45 minutes. The final second-round interview took place on May 31 at 4 p.m. with Mr. December in his room. This interview lasted 20 minutes. No unusual circumstances occurred during any of the interviews.

I transcribed the audio files of interviews using Google Voice Typing. I played the recordings from the digital recorder next to the microphone in my computer and engaged voice typing in a Google Doc and let it run throughout the length of the interview. I entered punctuation and fixed some of the text due to a few inaccuracies.

After an interview was transcribed, I copied and pasted individual thoughts and ideas into spreadsheet cells in Microsoft Excel.

Level 1 Data Analysis

For Level 1 data analysis, I developed a codebook, which included definitions, inclusion and exclusion criteria, as well as sample quotes for each a priori code (see DeCuir-Gunby, Marshall, & McCulloch, 2011). I copied and pasted transcripts verbatim into a Microsoft Office Excel spread sheet. Text excerpts that included a single idea or thought were put into its own cell in the spreadsheet. I set up Excel to use drop down menus and data validation, so that I could assign a priori codes from the SAMR model and TAM. The SAMR model and TAM each had their own columns so I could assign codes aligned to both frameworks if I needed to. Each excerpt was assigned a code if appropriate, although not all text excerpts were assigned codes. Each interview was assigned to one tab. Using the a priori codes for the SAMR model and TAM and referring to the codebook continually, I assigned excerpts with codes. The process of coding was iterative. I assigned text excerpts to a priori codes in the spreadsheet and made adjustments and clarifications in the codebook as my understanding of the application of my codes became clearer, as suggested by DeCuir-Gunby et al. (2011). Many instances arose that necessitated that I add to or completely change descriptions or inclusion or exclusion criteria. Several were changed based on the refinement of my codebook. As I was able to narrow the criterion, I could more accurately assign a code to the text. All of my a priori codes were evident in the Level 1 data analysis. However, an additional code emerged, that because I was receptive to what the data were revealing (as

suggested by Saldaña, 2015) I added an emergent code to the Level 1 codebook. See Appendix B for the finalized codebook for Level 1 coding.

Level 2 Data Analysis

During the process of Level 2 coding each of the tabs were aggregated into one tab which contained all text excerpts and associated codes. By analyzing each group of text excerpts using constant-comparison where by a researcher will use an inductive data coding process of constant categorizing and comparing qualitative data suggested by Merriam and Tisdell (2016), additional codes began to emerge. Each of these emergent codes were documented in the codebook with descriptions, detailed properties, inclusion and exclusion criterion and an exemplar text segment. During Level 2 coding, three themes emerged for level of technology implementation (see Table 5), and five themes for technology acceptance (see Table 6). After Level 2 coding was complete, a copy of the coding Excel sheet was sent to an inquiry advisor to review all coding to verify and to make suggested adjustments. The suggestions were accepted, the codebook was updated and the assigned code, re coded to reflect the suggestion. See Appendix A for the finalized codebook for Level 1 coding.

Table 5

Emergent Themes for Level of Technology Implementation

	Emergent Theme #1	Emergent Theme #2	Emergent Theme #3
Substitution	Paper and pencil replacement	Word processing for literacy	Capturing images with camera function
Augmentation	Digital resources access	Collaborative environments	
Modification	Multimedia creations	Gamification style activities	
Redefinition	Virtual or augmented reality	Adaptive software	

Table 6

Emergent Theme for Technology Acceptance and Decision-Making

	Emergent Theme #1	Emergent Theme #2	Emergent Theme #3	Emergent Theme #4	Emergent Theme #5	Emergent Theme #6
Outcome Expectancy	Student autonomy	Authentic audience	Student ownership	Student engagement		
Task Technology-Fit	Generate data to inform	Academic intervention and differentiation	Managing assignments and grading			
Social Influence	Perception of need for more devices	Pressure to use ICT	Networking	Pressure due to performance	Reliability of technology	
Personal Factors	Integration for student interest	Teacher preference	Teacher perceived readiness			
Student Technology Readiness	Student technology ability to produce a product	Student readiness to navigate online (literacy)	Student ability to interface or operate a device	Student digital citizenship and online safety	Teacher trust in student to use technology	Digital natives

Evidence of Trustworthiness

Trustworthiness can be achieved at a higher degree when factors such as credibility, transferability, dependability, and confirmability are addressed. In the subsequent section, these factors are addressed and a description of how they were upheld is provided.

Credibility

Credibility was ensured as described in Chapter 3. For qualitative research, Merriam and Tisdell (2016) defined credibility as the question of research findings being congruent with reality. A researcher interested in establishing credibility take the

recommendation of Merriam and Tisdell by using one or all of the strategies including triangulation, respondent validation, seeking discrepant data, and submitting to peer review. I employed each of these strategies in my study in an effort to produce research that is as credible as possible. Below are the ways in which I address each of the strategies suggested by Merriam and Tisdell.

Triangulation, according to Thurmond (2001) is defined as "the combination of two or more data sources, investigators, methodologic approaches, theoretical perspectives, or analytical methods within the same study" (p. 253). In the completed study, this was achieved by having two rounds of interviews at different times. The first round of interviews included questions that specifically addressed how K-5 students used ICT in an attempt to generate deep and rich descriptions. I made sure to schedule round two interviews no less than forty-eight hours after the initial interview. Round 2 interviews included questions that addressed a teachers' perception of factors that affect their decision-making.

In an effort to make sure that the data generated from the interviews was recorder accurately, I sent the transcript of the interview to each individual participant for review. This process is called member checking, which involves allowing participants to review the transcription of their interview to better ensure accuracy in the recorded information thereby ensuring greater credibility (Carlson, 2010; Houghton et al., 2013). I asked participants to look for any inaccuracies, or if there were additional thoughts they wanted to include. All 12 participants responded that the transcription was accurate and there was nothing else they wanted to add.

Throughout the coding process, I searched for discrepant data. One additional code, student technology readiness, seemed to permeate throughout the interviews so it was added to the list of a priori codes. This code was included in overall analysis.

Transferability

Trustworthiness is achieved in research by assuring that the findings of a study can be reproduced in other situations (Merriam & Tisdell, 2016). This can be accomplished by generating deep and rich descriptions of the context in which the phenomenon occurs. I achieve transferability by providing detailed information about the district, campuses, population of students, as well as the teacher participants. In addition, the data generated from the interviews provided significant insight into the phenomenon of teacher decision-making pertaining to student use of educational technology at various levels.

Dependability

The reliability of a study depends on if it can be recreated, and if consistent methods of data collection instruments are used across participants and settings (Merriam & Tisdell, 2016). Due to the level of detail and transparency provided in all documentation of decisions, and considerations in this study in a researcher journal, I anticipate that future researchers will be able to replicate this study and obtain similar results. Watt (2007) wrote that keeping a researcher journal provides for a stronger understanding of the qualitative process, and the phenomenon being studied thus yielding higher dependability. Documentation included detailed accounts of the interview process, research design specifications, research questions, interview questions, interview

protocol, coding process, and reflective review. Also, since this study only included interviews as the sole source of data, following the "interview protocol refinement" strengthens dependability. Yeong, Ismail, Ismail, and Hamzah (2018) suggested that maintaining a reliable interview protocol is essential in the attempt to obtain quality interview data. Yeong et al. recommend steps they call the interview protocol refinement which this study also included. The steps were "(1) ensuring alignment between interview questions and research questions, (2) constructing an inquiry-based conversation, (3) receiving feedback on interview protocols and (4) pilot testing of the interview questions" (Yeong et al., 2018, p. 2700). I followed these steps to ensure alignment between interview questions and research questions were. Interview questions were designed to elicit deep detail and rich descriptions. The development of the interview protocol for this study was subjected to several stages of development and refinement. Lastly, practice interviews were held to pilot the questions included in the protocol. Adjustments were made based on feedback and results of the piloted questions.

Confirmability

Yet another aspect where trustworthiness can be increased in a study is to provide other researchers the ability to trace and review the course of a study, step-by-step throughout the entire process. I have taken steps to disclose potential bias, and to report all actions that have been taken throughout the course of this study. To the best of my ability, I have reported all decisions, actions, and reasons for making them to establish complete transparency, and accuracy.

Results

In this section I have organized the results by research question. Each result also includes a frequency table that provides a visual representation for the data.

Student Use of Technology in K-5 Classrooms

The first research question was how do K-5 teachers have students use ICT in the classroom? To answer that question, I asked teachers to describe how they have their students use technology. I used the SAMR model to categorize their responses. The frequency of their responses for each level is found in Table 7. The majority of frequencies for a priori codes aligned to the SAMR model fell under the substitution (22/62 codes, 35.5%) and augmentation (22/62 codes, 35.5%) categories.

Table 7

Frequency of A Priori Codes for Each Teacher Aligned to the SAMR Model

	Substitution	Augmentation	Modification	Redefinition	
January	6	3	0	4	
February	0	0	4	1	
March	1	1	0	1	
April	1	1	1	0	
May	1	0	0	0	
June	0	4	3	0	
July	1	2	1	0	
August	1	4	1	0	
September	2	2	0	0	
October	0	4	2	0	
November	5	0	0	0	
December	4	1	0	0	
Total	22 (35.5%)	22 (35.5%)	12 (19.3%)	6 (9.7%)	Total = 62 100%

The frequency of modification codes was slightly less than half the others (12/62 codes, 19.3%), and the remaining codes fell under redefinition (6/62 codes, 9.7%).

Substitution. The code substitution occurred 22 total number of times for 35.5% of the total codes, see Table 8. All but three teachers described having their students use substitution level. Three emergent codes revealed how teachers were implementing within this level, see Table 8.

Table 8

Frequency of Substitution Emergent Themes for Each Teacher

	Paper and Pencil Replacement	Word Processing for Language Literacy	Capturing Images with Camera	
January	4	2	0	
February	0	0	0	
March	0	0	1	
April	0	1	0	
May	0	0	1	
June	0	0	0	
July	1	0	0	
August	1	0	0	
September	1	1	0	
October	0	0	0	
November	2	1	2	
December	3	1	0	
Total	12 (54.5%)	6 (27.3%)	4 (18.2%)	Total 22 (100%)

The first, and most represented emergent theme for the substitution level was paper and pencil replacement (12/22 codes, 54.5%) and was represented in six of the twelve teachers interviewed (See Table 8). Teachers described students using technology for activities that are simple substitution for activities that could be done with paper and a pencil or pen. For example, several teachers had students identify words, letters, colors, and shapes by clicking on them with an iPad, or drawing pictures using the touch screen. Mrs. November mentioned that, “my kids will write about pilgrims and will draw a picture of them using Seesaw.”

Another emergent code was word processing for literacy (6/22 = 27.3%). Five out of the 12 teachers described students using technology in this way. An example that Mrs. July provided when she said, “students compare two or more different genres of books both in the fictional realm and then in the nonfiction realm using a document in Google Classroom, then submit it to me when they are done” which was classified as word processing. Mr. December provided an example of word processing for literacy by giving a description of an activity his students completed saying, “they are matching pictures of objects to the first letter of the objects name and also using a program called Lexia to help them improve phonics skills and letter recognition.” Mrs. April discussed activities where her students practice basic typing saying that, “by the time they leave this class, they would be able to type and have word processing skills.”

The third and final emergent code associated with substitution is capturing images with the camera function (4/22 = 18.2%). For example, Mrs. November and a few other teachers described how students enjoy using the application Seesaw on the iPad to capture images of an activity they just completed to show their parents. Mrs. September said, “within the Seesaw app they will recode their voice and take pictures of things they just made to send to their parents.”

Augmentation. The code augmentation occurred the same number of times in the data as substitution (22/62 = 35.5%), see Table 9. Table 6 shows the frequency of augmentation codes for each teacher for the two emergent themes that came out from this code. All but three teachers (February, May, and November) at some point in their interviews mentioned students using technology at the augmentation level.

Table 9

Frequency of Augmentation Emergent Codes for Each Teacher

	Access to digital resources	Collaborative environments	
January	2	1	
February	0	0	
March	1	0	
April	0	1	
May	0	0	
June	4	0	
July	1	1	
August	4	0	
September	1	1	
October	4	0	
November	0	0	
December	1	0	
Total	18 (81.8%)	4 (18.2%)	Total 22 (100%)

The emergent code for augmentation that was represented the most (18/22 = 81.8%) was student access to digital resources. See Table 9. Several teachers expressed a desire for their students to use ICT based on the ability to make digital resources accessible during learning activities. Mr. December provided an example of his students using the web passed program PebbleGo, where his students are able to do research about subjects that interest them with an emergent technology-friendly interface. He said, “we just used PebbleGo for research on animals.” Similarly, Mr. January described a process where he provides the majority of his class resources to his students in Google Classroom so they can “access them anywhere and anytime.” Mrs. October discussed how she created a hyperdoc using a Google Doc to provide her students access to resources such as YouTube videos, Khan Academy, online textbook activities and lessons. She mentioned that, “My students access hyperdocs located in Google classroom and choose

what they do in any order." Using Google Apps for Education and creating multiple pathways to learning in a hyperdoc provides flexibility and increased access to digital resources. Similarly, Mrs. April used a digital menu style document in Google where students could access multiple pathways and choose the rigor, they were comfortable with while still having to accumulate a certain amount of points for each activity. She described it as saying, "easier activities were worth less, and the more challenging activities were worth more." Mrs. August specifically address the importance of her students having access to online resources, she mentions that, "paper textbooks have finite information whereas there is much more information online." When students have access to digital resources they can be empowered to learn more deeply; when their access information is finite, their learning is limited.

The second emergent code in augmentation was collaborative environments (4/22 = 18.2%) and appeared once for four different teachers, see Table 9. Mr. January expressed a desire to enable his students to collaborate in and outside of class using Google Apps for Education. "Many of my projects use Google Apps for that reason" he remarked. Mrs. April said she encourages her students to use the iPads she checks out for projects to "collaborate together and work at the same time or when it's convenient for them after school."

Modification. The code modification occurred slightly less than one fifth the number of times compared to the other codes (12/62 = 19.3%), see Table 5. Table 10 shows the frequency of modification codes for each teacher for the two emergent themes that came out from this code. At some point in their interviews, Mrs. February, April,

June, July, August, October mentioned students using technology at the modification level.

Table 10

Frequency of Modification Emergent Codes for Each Teacher

	Student multimedia creations	Gamification style activities	
January	0	0	
February	3	1	
March	0	0	
April	1	0	
May	0	0	
June	3	0	
July	1	0	
August	1	0	
September	0	0	
October	1	1	
November	0	0	
December	0	0	
Total	10 (83.3%)	2 (16.7%)	Total 12 (100%)

The most common emergent code for modification was multimedia creations (10/12 codes, 83.3%) and was represented in 6/12 interviewed, see Table 10. The majority of teachers who cited students using educational technology at the modification level did so with the example of student creation of multimedia which includes elements of video, text, sound, images, and graphics. For example, Mrs. April encourages her students to use the Chromebooks she has in her class to "create multimedia to share with others." When a teacher provides activities for students to demonstrate their learning using multimedia platforms they are using technology at the modification level. Another example of students using multimedia is provided my Mrs. February, "my students create a multimedia slideshow throughout the year." A year-long cumulative slideshow or

portfolio is an effective way to show growth over throughout the year and also to encourage student reflection. For example, Mrs. July wanted her students to "create some type of reflection after every unit using multimedia." These are good examples of students using technology at the modification level of the SAMR model because of their use of multimedia elements like video, text, images, graphics, and sound.

The second emergent code was gamification style activities (2/12 codes, 16.7%) and was represented in 2/12 teachers interviewed, see Table 10. The examples which teachers refer to most often throughout the interview is when students use an online software math program called DreamBox or Education Galaxy. Both online software programs assist students with math facts and building numeracy and fluency in a gamification style environment. For example, Mrs. October mentioned that Education Galaxy were regularly used during class time. Mrs. February spoke about her students using DreamBox, and RazKids which she mentioned, "includes competitions where my students can compete with each other, it makes learning fun."

Redefinition. The code redefinition occurred least out of all other codes (6/62 codes, 9.7%) less than one-tenth the number of times compared to the other codes, see Table 11. Table 8 shows the frequency of redefinition codes for each teacher with two emergent themes that came from this code. Only three teachers (January, February and March) at some point in their interviews mentioned students using technology at the modification level. One teacher who discussed his students using VR had four codes, Mrs. March and February mentioned students using adaptive online software.

Table 11

Frequency of Redefinition Emergent Themes for Each Teacher

	Virtual reality	Adaptive software	
January	4	0	
February	0	1	
March	0	1	
April	0	0	
May	0	0	
June	0	0	
July	0	0	
August	0	0	
September	0	0	
October	0	0	
November	0	0	
December	0	0	
Total	4 (66.7%)	2 (33.3%)	Total 6 (100%)

The first emergent code for redefinition, was VR (4/6 codes, 66.7%). Only one teacher mentioned using virtual reality in the classroom and was coded for four different text excerpts. Mr. January described his grade 5 students using his classroom set of VR goggles to "view landforms, battlefields, and other locations around the globe that they would not be able to see otherwise," which is why it is an exemplar of students using technology at the redefinition level. In addition, he discusses that the technology is getting better. He can "integrate video clips on a particular location as well as text messages as an overlay in the in the experience."

The other emergent code for redefinition was adaptive software (2/6 codes, 33.3%). Two teachers (Mrs. February and Mrs. March) mentioned using the adaptive software DreamBox. Mrs. March explained that, "I appreciate the functionality and adaptability of DreamBox because it monitors and measures every aspect of a student's

interface when inside the program." Each key stroke, and second that passes is measured and recorded. The program considers multiple aspects and logarithmically adapts the rigor and skill level of subsequent questions and activities in real time. Mrs. February said that, "my students log into DreamBox and Raz-Kids which are adaptive programs to practice skills…" Mrs. March and February used those for students to improve numeracy, and math fluency. The online software is adaptive because it will increase or decrease the rigor of the questions and activities based on all the input from the student. Using adaptive software like DreamBox, which is a tool that provides a learning experience not possible otherwise.

Influence on Teacher Decision-Making

The second research question was what influences teacher decisions to have students use technology? This research question helped me to focus me on the influences on teachers' decision-making process regarding how they choose to have students use technology. I used the TAM to categorize their responses. The frequency for each teacher by TAM category level is found in Table 12. In addition to the a priori TAM codes, an additional emergent code appeared that I titled, student technology readiness.

Table 12

Frequency of A Priori Themes for Each Teacher Aligned to TAM

	Outcome Expectancy	Task-Technology Fit	Social Influence	Personal Factors	Student Technology Readiness	
January	5	9	4	1	3	
February	4	3	2	3	3	
March	1	1	2	0	5	
April	3	0	0	1	2	
May	2	2	2	0	5	
June	3	3	3	1	5	
July	1	0	1	0	4	
August	4	4	0	0	2	
September	1	2	3	0	5	
October	5	4	4	4	5	
November	4	0	2	2	2	
December	6	2	3	5	2	
Total	39 (25.1%)	30 (19.3%)	26 (16.8%)	17 (11.1%)	43 (27.7%)	Total 155 (100%)

Outcome expectancy. The code outcome expectancy occurred 39 times out of 155 total codes (25.1%), and by each of the participants at least once. See Table 13. Only the student technology readiness code appeared more often. There were four emergent themes for outcome expectancy (see Table 13). They were student autonomy, authentic audience, student ownership, and student engagement. The most frequent emergent theme was student autonomy followed by student engagement.

Table 13

Frequency of Outcome Expectancy Emergent Themes for Each Teacher

	Student Ownership	Student Autonomy	Student Engagement	Authentic Audience	
January	1	1	3	0	
February	1	2	0	1	
March	0	1	0	0	
April	1	1	0	1	
May	0	2	0	0	
June	1	0	1	1	
July	1	0	0	0	
August	3	0	0	1	
September	1	0	0	0	
October	3	1	1	0	
November	1	3	0	0	
December	3	1	1	1	
Total	16 (41%)	12 (30.8%)	6 (15.4%)	5 (12.8%)	39 (100%)

When teachers spoke of factors that affected their decision-making, slightly over two-fifths of them referred to perceptions of factors that were coded as student ownership with 16/39 instances (41%). See Table 10. Only one teacher did not refer to a factor like student ownership that influenced their decision-making (Mrs. May). Student ownership emerged the most frequent theme in the outcome expectancy code. This theme arose due to teachers' desires to keep students accountable by increasing ownership over their learning. Mrs. August chose to use technology so that her students could, "see progress and assess themselves as they are learning at their own pace." Using technology, teachers can provide students the ability to have more control over the pace of their learning. Mr. December wanted to use technology so his students could, "keep getting better and better at their skills and allow themselves to do more by themselves." Teachers can increase

student autonomy in learning by using technology and providing ways that students might increase ownership and performance in academics.

The theme student autonomy occurred 12 out of 39 times (30.8%). See Table 13. All but four teachers mentioned the decision-making factor student autonomy (Mrs. June, July, August, and September). The theme student autonomy became evident when teachers like Mrs. August mentioned her students using Google Classroom to, "get feedback on questions and can see for themselves what they missed and why." When students learning independently, possible assisted by technology, they are able to identify misconceptions in learning without the teacher having to tell them. Also, Mr. January suggested that technology can build a student autonomy when he said, "it gives them a digital lab so they can have all the activities and they can choose what they want to work on." Student autonomy is closely related to student choice in learning, and technology can help increase both. Mrs. March reflected on the way her student use technology and concluded that, "they can keep going, and they can go at their own pace, they don't have to stop for me." One of the most indicative examples of technology helping to build student autonomy is when Mrs. November said, "technology, like the recordings I make of me pronouncing the letters and words with strategies if they get stuck, help my students to practice in class and at home."

The third most frequent emergent theme within the outcome expectancy code, was student engagement with 6 out of 39 times mentioned (12.8%). See Table 13. Less than half of all teacher participants mentioned a factor like student engagement influencing their decision-making (January, June, October, and December). Mrs. June

said that she "is excited when her students are excited." She also captured the theme in her words, "when I provided technology for my students to use, they were more engaged and interested in participating in the activities." It seems that learning with technology can provide a degree of novelty and engagement for students. Mr. January commented that he provides VR for his students so they are engaged in the learning process. For example, he said, "they love VR, but it has about a 5- or 10-minute activity because that is the cap of their interest threshold." In this example Mr. January used technology at the redefinition level for purposes of student engagement.

The last emergent theme, authentic audience, was 5/39 in frequency (12.8%) with 6 teachers providing example in each theme (see Table 13). These themes highlighted teachers who seek to make learning meaningful by creating an authentic purpose and audience like Mrs. February. She remarked that she did just that because, students are "more engaged in an assignment and they think more carefully if it is something that will be shared with an authentic audience."

Task-Technology Fit. The code TTF occurred 30/155 times (19.3%). See Table 9. There were three emergent themes for TTF academic intervention differentiation, generate data to inform learning, and managing assignments and grading (see Table 14). The most frequent emergent theme was technology use for academic intervention and differentiation, followed closely by using ICT to generate data to inform learning, and lastly using ICT to help manage assignments and grading (See Table 14). Seventy five percent of all teachers interviewed mentioned a factor of technology acceptance that fit into an emergent theme in TTF (Mrs. April, July, and November).

Table 14

Frequency of Task Technology-Fit Emergent Themes for Each Teacher

	Academic Intervention/ Differentiation	Generate Data to Inform Learning	Managing Assignments and Grading	
January	6	2	1	
February	1	1	1	
March	0	1	0	
April	0	0	0	
May	1	0	1	
June	1	2	0	
July	0	0	0	
August	2	1	1	
September	0	1	1	
October	2	1	1	
November	0	0	0	
December	0	1	1	
Total	13 (43.3%)	10 (33.3%)	7 (23.4%)	Total 30 (100%)

The most frequent emergent theme was a perception or activity under academic intervention or differentiation 13/30 frequencies (43.3%). For example, Mr. January, said that educational technology is used in his class partly so that, “technology can address a misconception that a kid has or a weakness in a skill.” Technology can also give a teacher options for intervention and flexibility in how to differentiate for students. For example, Mrs. October, integrated technology and formed small group rotations where iPads were one station among others. She said, “technology basically allows for there to be two of me, because while working in a hybrid doc, they are learning independently, and I am pulling several small groups each day.” Using technology assists teachers in monitoring student progress and providing differentiation or intervention when needed. Mrs. May said that, “DreamBox will allow me to monitor student performance to see what they need help with.” Teachers may find that technology can assist with differentiation and intervention but also in determining when they are needed.

In addition to technology assisting with differentiation and intervention, it can help informing teachers and students with when and where they need assistance in the learning process. For instance, Mrs. March said, “I really enjoy how I can go back and look at the student data from the software, it shows me specifically where students struggle and where they might need a little bit more practice.” Mrs. August mentioned something similar, “I am able to get a closer look at any class results and pinpoint the students that are not understanding or need to review more.” Teachers have students use technology when it helps inform them about students’ needs for remediation, more skill practice, or learning previously learned content in a new way.

Lastly, among the emergent codes under TTF teachers revealed that when students use technology, it can assist them in workflow with assignments and grading (7/30 = 23.4%). For example, Mrs. October said that, “having a station with technology, helps students’ complete assignments and easily turn them in when using Google Classroom.” Mr. January remarked that he enjoys using Google Classroom, “so I can see their comments, grade their assignments, and then I can send feedback much more quickly.” Without the use of technology, the process of turning in assignments, grading, and providing feedback can be more laborious and time consuming. Techers are finding ways to make that process more streamlined when their students use technology. Mrs. May specifically chooses for students to use a technology resource like Google Classrooms because it is easier for her and her students to process and communicate on assignments. For example, she said, “I do like that the majority of educational technology programs that are coming out all interface with Google classrooms… It’s easier for my

students and me to process assignments. Teachers and students using technology may find that their productivity increases. Communication between teachers and students is an essential part of the learning process. Mrs. September underscores that idea and adds that she and her students value technology by saying, "[students] really liked it because they see comments from me which is immediate feedback. I can go through and look at any of the documents that they started in the shared with me drive." Google and other educational technology resources are giving teachers and students tools to be more productive.

Table 15

Frequency of Social Influences Emergent Themes for Each Teacher

	Networking	Teacher Perceives Need for More Devices	Reliability of Technology	Pressure due to Academic Performance	Pressure to Use ICT	
January	2	0	1	1	0	
February	1	1	0	0	0	
March	1	1	0	0	0	
April	0	0	0	0	0	
May	0	1	0	0	1	
June	1	0	2	0	0	
July	0	1	0	0	0	
August	0	0	0	0	0	
September	0	3	0	0	0	
October	2	0	0	1	1	
November	1	1	0	0	0	
December	0	0	1	2	0	
Total	8 (30.8%)	8 (30.8%)	4 (15.4%)	4 (15.4%)	2 (7.6%)	Total 26 (100%)

Social influences. The code social influences occurred 26/155 (16.8%) times. See Table 15. There were five emergent themes for social influences, teacher perceived need for more devices, pressure to use ICT, networking, pressure due to academic performance, and reliability of technology. The most frequent emergent themes were the

teacher perception that they needed more devices and networking, followed by, reliability of technology, and then pressure due to academic performance, and then lastly pressure to use ICT See Table 15.

The most frequent emergent themes in the social influence code were comments where teachers perceived the need for more devices with 8 out of 26 (30.8%) and networking (8/26 comments, 30.8%), as factors that affect the decision-making of teachers when choosing for their students to use ICT in learning activities. See Table 15. In several instances, teachers cited a desire to have more devices so their students could use them to access digital resources. For instance, Mrs. November said, "I just wish we had more ChromeBooks, so my students did not have to share as much." In addition, Mrs. September has to decide which activities her students can do and which they cannot due to the number of devices she has. She said that most of her activities have to be collaborative where students share "due to the lack of technology."

During interviews, I asked if teachers were influenced by networking, professional development, conferences, or professional learning committees when deciding to integrate technology into lessons for students to use. Several examples emerged where teachers cited conferences, seeing others in their classroom, and professional development as being factors that influence teachers' decision making. For example, Mrs. November said that she had an "interest in green screen technology after it was demonstrated at a conference." Mrs. February also said that if she gets "good ideas from someone, I want to dive right in and try it with my kids", and that she has gotten

"lots of ideas from conferences and professional development as well as from other online sources like Twitter…"

Several teachers cited technology reliability with four out of 26 comments (15.4%) as a factor that affects their decision-making to have students use ICT. See Table 15. Mr. December would like to use more technology, but he states that "our WiFi network needs to be more reliable, so we can use tech and not be forced to use paper and pencil activities all the time." Teachers like Mr. January expressed frustration when he has to "constantly troubleshoot and I'm not able to teach." Teachers also mentioned that technology gets old and needs to be updated. Mrs. March shared that sometimes she has to decide not to use technology in activities because, "the devices are older and out-of-date…" When technology is not reliable it might negatively impact students' ability to learn, and a teachers' ability to teach. Technology reliability also has an influence on teachers' decision-making to have students use ICT.

In education, the pressure to perform is ubiquitous, which showed up as a theme called pressure due to academic performance from three teachers (January, October, and December). They commented 4 times out of 26 about this theme (15.4%). See Table 12. Trying new resources and approaches in education is sometimes welcomed and other times not. Academic pressures from administration can deter or encourage some teachers to be innovative or more traditional in the activities that teachers create for their students. For example, Mrs. October said, "it's hard because we know principals are looking at us and what our students are doing in terms of test scores, so I will choose not to try something new." She adds that principals might not be willing to allow teachers to

deviate from a prescribed format of instruction because “assessment scores are important and there is a lot of pressure to do the things that teachers have always done and the things we already know work.” Sometimes teachers have to choose not to use technology due to the pressures of academic success that are present on a campus.

Even though teachers are professionals and adults, they do not escape the influences of peer pressure which led to the creation of a theme called pressure to use ICT. Two out of 12 participants commented 2 out of 26 times (7.6%) about peer pressure to have students use ICT. See Table 12. Mr. December provided the best example of how peer pressure affects his decision for students to use ICT in his room when he mentioned that, “my colleagues influence is the strongest factor for me” when he decides for his students to use ICT. He followed up with that comment with an additional thought that he “does not want to be the only one who’s not using technology or doing something fun and innovative with kids.” Teaching is a social activity and decision-making can be influenced by social pressures. Just walking by a nearby classroom and seeing some that another teacher is doing can be an influence on decision-making. For instance, Mrs. October’s partner was using blended learning in her class students on ChromeBooks and Google apps. She said that, my partner was using a blended learning style teaching model, so I noticed how effective it was and so I started it too.” Seeing how other students use technology in class can inspire teachers to try it in their classroom too.

Table 16

Frequency of Student Technology Readiness Emergent Themes for Each Teacher

	Students' Ability to Interface or Operate Device	Student Technology Ability to Produce a Product	Teacher Trust in Student to Handle and Operate ICT	Student Readiness to Navigate Online (Literacy)	Digital Natives	Student Digital Citizenship and Online Safety	
January	1	2	0	0	0	0	
February	2	1	0	0	0	0	
March	4	0	0	1	0	0	
April	2	0	0	0	0	0	
May	3	0	0	1	1	0	
June	1	1	1	0	1	1	
July	3	1	0	0	0	0	
August	0	1	1	0	0	0	
September	0	2	2	0	1	0	
October	1	2	2	0	0	0	
November	2	0	0	0	0	0	
December	1	0	0	1	0	0	
Total	20 (47.7%)	10 (23.8%)	6 (14.3%)	3 (4.8%)	3 (7.1%)	1 (2.3%)	Total 43 (100%)

Student technology readiness. The only emergent code from level 1 coding was student technology readiness, which occurred the greatest number of times, 43 out of 155 instances (27.7%). See Table 16. There were six emergent themes for student technology readiness which were student technology ability to produce a product, student readiness to navigate online (literacy), students' ability to interface or operate a device, student digital citizenship and online safety, and lastly, teacher trust in student to handle *and operate ICT* (see Table 16). The code emerged as teachers all throughout interviews began to express a reluctance or willingness for their students to use ICT based on the perception that teachers have of a students' ability and readiness to use technology.

The most frequent theme that emerged from interviews within the code was by far a students' ability to interface and operate with a device with 20 out of 43 participants commenting (47.7%). See Table 16. For example, Mrs. July expressed concern with choosing for her students to use a Chromebook for certain activities because,

> when students come to class and they do not have even the basics for getting started with how to operate a Chromebook or log on to a computer we have to from load all of that and sometimes I just do not have time.

Sometimes teachers are willing to take the time to teach all of the navigation and operation skills to students, but it takes time and some planning. Mrs. March said that, "the other consideration is breaking each one of the steps down for directions and procedures, they need to log on and navigate to the software by themselves." After asking a follow up question about her students having difficulty with navigating and operating the devices, she remarked that, "many of them do not have any prerequisite skill of knowledge of navigating inside software or using hardware so it is a bit challenging." Students not having enough basic technology navigation skills can make choosing for them to use it challenging. Elementary teachers are faced with unique challenges as it relates to decision-making to have students use ICT which include student prerequisite skill.

The second most frequently mentioned decision-making theme that arose during coding was student technology ability to produce a product with 10 out of 43 total frequencies (23.8%) and seven teachers citing examples. See Table 16. Teachers want to know that the investment in time, effort and planning will pay off when their students use technology. The perception that a student will benefit from the use of technology in learning is characterized as a students' ability to produce a product now or in the future. Mrs. April explains that "in Grade 5 they should be able to log on to the computer by themselves, navigate to Google Applications, and be able to create folders within their

drive." While working with students in all elementary grade levels, she told me that, "we try to teach how to appropriately place the hand on the mouse and click and drag objects." She does this with the expectation that all students will gain valuable knowledge and experience so they can "successfully use technology in the classroom and when they move on to higher grade levels." Mr. January mentioned that when he teaches students who do not have the prerequisite skills to use technology successfully and has to teach them, it is because "I want them to be fluent and be able to submit assignments and operate all kinds of hardware and software… it's something that will help them in the future." Even if students may or may not have the prerequisite knowledge, some teachers see the value in taking instructional time to teach how to use it.

The next frequent emergent theme that occurred was teacher trust in students to handle and operate ICT 6 times out of 43 total comments (14.3%). See Table 16. Classroom procedures and expectations for technology use are taught and reinforced throughout the year. Mrs. August said that, "expectations for technology use in the classroom are important before they even get to use it. I need to know that they are ready and will use the device responsibly." Most technology is expensive and not easy to replace if broken, so teachers will often take time to teach expectations so that students are more careful. Mrs. September said that she "has to take into consideration the kind of class she has in another example, "you will always run into a few who don't make the right choices." Teacher trust in students is another important factors that influenced decision-making when teacher's think about their student using ICT.

Digital natives, the next theme that emerged during Level 2 coding, comprised 3 out of 43 instances (7.1%) from three teachers. See Table 16. A few teachers described the emergent theme that students are born with technology around them and often use it from a very early age. For instance, Mrs. June said, “you just can’t teach the same way we used to. If we teach like we did in the 90s without technology, students would not want to learn much from us.” Sometimes students just expect that teachers will make technology available to them for learning activities. Mrs. September mentioned something similar when she said that, “it’s their generation, the kinds of students that we have in class now, using technology is what they're used to.” At home, in public, and at school, many students are surrounded with technology. Digital natives are used to technology and sometimes expect to use it in the learning process.

Another theme that emerged from interviews was student readiness to navigate based on literacy where 3 comments out of 43 were made (4.8%). See Table 16. Mrs. May spoke about her students’ digital citizenship specifically related to online safety. Mrs. May said that she has to be deliberate about the activities her students can engage with using technology because “my students are just learning to read so it’s a challenge to communicate directions to them in a digital activity.” Student literacy bears some influence in a student’s ability to conduct searches and input information. Mrs. March had similar concerns when she said, “their web access would be limited because of their ability to type and spell words.” There are ways around the challenges of emergent literacy in early grades, but teachers sometimes feel limited in deciding for students to use ICT due to this factor.

The final emergent themes that emerged was student digital citizenship and online safety which occurred 1/43 (2.3%). See Table 16. This theme was only brought up once with when Mrs. June expressed that keeping her students safe online is a high priority for her. She said, “I want to say that internet safety and digital citizenship are very important, so I always have my kids use the resources that I know will keep them safe.” Online safety and digital citizenship are easier to manage in schools that have security measures in place, however teachers like Mrs. June are still vigilant and cautious about what students have access to.

Comparison of Decision-Making by Levels of Implementation

To answer Research Question 3, I was able to compare the decision-making process among K-5 teachers who use technology with students at varying levels of implementation. After collecting data on how teachers have students use technology, and about teacher decision making, I compared the data to see whether these two elements revealed any patterns. I categorized each of the 12 teachers into one of the four levels of the SAMR model. Based on codes from their interviews, I placed them in the highest level of implementation they reached, even if it was just one occurrence. Results showed that the teachers in the substitution, augmentation, and redefinition levels of integration cited factors in the student technology readiness category most frequently. The teachers included in the redefinition level of the SAMR model were most frequently affected by TTF factors in their decision-making process. Tables 17 and 18 provide the frequency of decision-making factors among the teachers categorized at each level of the SAMR model.

Table 17

Comparison of Decision Making by Enhancement Levels of Integration

	Outcome Expectancy	Task-Technology Fit	Social Influence	Personal Factors	Student Technology Readiness
Substitution	12	5	10	7	14
Augmentation	10	8	5	4	11

In table 17, teachers were categorizing into a level of integration based on how the describe their students using technology. At the enhancement level, which includes substitution and augmentation, the greater frequencies that occur are in the student technology readiness category followed closely by outcome expectancy. It is important to note that five out of six teachers in the enhancement level of technology integration taught kindergarten through Grade 2.

Table 18

Comparison of Decision Making by Transformation Level of Implementation

	Outcome Expectancy	Task-Technology Fit	Social Influence	Personal Factors	Student Technology Readiness
Modification	12	8	7	5	15
Redefinition	6	10	6	1	8

In Table 18, which is comprised of teachers categorized by student use of technology at the transformation level of integration, the most frequent factor that occurred for teachers in the modification level of technology integration was student technology readiness. This is similar to those in Table 14, however the teachers in the redefinition category, were more frequently influenced by TTF. It is important to note

that 5 out of 6 teachers in the enhancement category taught in Grades 4 and 5. In addition, teachers in the redefinition category were only teachers of Grades 4 and 5.

Summary

The key findings for the study were based on the research questions and themes that emerged during data analysis. The key finding related to research question 1 was that K-5 teachers have students use ICT in the classroom most commonly at the substitution and augmentation levels of implementation. Teachers most often had students use technology for basic functions that allow for enhancement of a learning activity. For example, teachers described having students use technology instead of paper and pencil and accessed digital resources instead of accessing books or learning in an online collaborative environment, instead of being bound by place and time. The key finding related to research question 2 was that teacher decisions to have students use technology was influenced by all factors in the TAM, but mostly by the emergent theme of student technology readiness. In order to explore and ascertain the influences of teacher decision-making to have students use technology, I used the proposed influences developed by Gu et al. (2013) in the TAM. The key finding related to research question 3 was that the decision-making process among K-5 teachers who used technology at the redefinition level of the SAMR model differed from those at the lower levels of implementation. Key findings included teachers in the substitution, augmentation, and modification categories were influenced most frequently by the student technology readiness theme followed by outcome expectancy, while teachers who implemented technology in the redefinition categories were influenced most by TTF. The next chapter, Chapter 5, will include

interpretations of the findings, limitations of the study, recommendations, implications, and conclusion.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this qualitative study was to explore the decision-making process of K-5 teachers regarding implementation of ICT for student use at varying levels. Using generic qualitative inquiry, I explored K-5 teacher decision-making using the SAMR model and TAM as a framework to compare teacher participants responses from semistructured interviews. This study was conducted to address a gap in the literature related to elementary student use of technology and the potential benefit to increased understanding of the decision-making process of teachers who choose to use ICT for students.

Interpretation of the Findings

I explored the decision-making of K-5 teachers to have students use educational technology for learning purposes through Puentedura's (2013) the SAMR model and Gu et al.'s (2013) TAM. Some of the results of this study confirmed, disconfirmed, or extended the findings from the literature. I interpreted these results in relation to the themes organized by research question and the review of literature.

Student Use of Technology in K-5 Classrooms

Research question 1 was: How do K-5 teachers have students use ICT in the classroom? Key Finding 1 was K-5 teachers have students use ICT in the classroom most commonly at the substitution and augmentation levels of implementation. This finding confirmed existing empirical research in several ways. First, teachers in this study talked the most about how students use technology at the enhancement level, which includes

substitution and augmentation categories, and is consistent with what is described in existing empirical research. For example, Aubusson et al. (2014) described elementary students who were observed using technology for simple responses, like identifying and selecting words, shapes, and letters, on an interactive white board. Delgado et al. (2015) also reported students using cameras as part of an outdoor exploration activity. The results of this study confirmed that elementary teachers have students use technology at the substitution level for skills practice. Similarly, McDermott and Gormley (2016) observed elementary students who used software to remediate basic math and reading fluency skills. Teachers recognized an advantage when students used technology to participate in online collaboration for creating projects and participating in online activities similar to the findings of McKnight et al. (2016).

As part of Key Finding 1 related to student use of technology at the transformative levels of the SAMR model, the results both confirmed and extended the literature. The findings of this study confirmed student use to include creating digital movies and multimedia, which is similar Öman and Svensson's (2015) study. Another example of ICT use at the transformative levels of the SAMR model occurred in the Liao et al. (2015) study where second grade students played a math content-based adaptive game. Students using technology at the transformative level of integration was shown in a study where Spanish students used VR for content-based games (Akçayır & Akçayır, 2017). Hsu, Wenting, and Hughes' (2018) explanation of the challenges in having elementary-aged students use technology in transformative ways may be a reason for the lack of research, but the results from the current study provide evidence that some

teachers find ways of overcoming challenges to provide transformative experiences for young students.

Influences on Teacher Decision-Making

Research Question 2 was: What influences teacher decisions to have students use technology? Key Finding 2 was teacher decisions to have students use technology was influenced by all factors in the TAM but mostly by the emergent theme of student technology readiness. The findings from this study not only confirmed current empirical research that exists on factors that affect teachers' decision-making to have students use technology but also extended what is known due to an emergent theme in this study: student technology readiness. Among the consistencies between the findings in this study and what is currently known in empirical research is that outcome expectancy is the strongest predictor of technology acceptance (Davis, 1989; Venkatesh et al., 2003). For example, the results of this study confirmed research by Uluyol and Şahin (2016) that teachers perceived that technology will assist in creating a stronger sense of student autonomy and ownership. Domingo and Garganté (2016) described the importance of perceived engagement from 102 teachers. Perhaps this is why outcome expectancy is among the most frequently described factors for deciding to have student use ICT.

Another result confirmed by this study was that TTF has a bearing on K-5 teacher decision-making. For example, teachers reported expressing a desire for the technology that their students use to help in the performance of their job (de Aldama & Pozo, 2016). Similarly, Tosuntaş et al. (2015) concluded that teachers perceived that using ICT would increase teaching performance. When students use technology and the process of grading

and managing assignments can be streamlined, teachers seem interested in integrating technology into their practice for students to use.

Social influences affect a teachers' decision-making, which is consistent with Kusano et al.'s (2013) results where teachers perceived a need for more devices. Another impact on decision-making reported by Uluyol and Şahin (2016) was that the influence of other colleagues tends to influence the desire for students to use technology. Another factor that teachers perceive as an influence on their decision-making is the reliability of technology. Alenezi (2017) concluded that the reliability of a district's technology infrastructure is a factor that influences teachers' decision-making to have students use ICT. Teachers have to make decisions about which resources students use, and the reliability and dependability of a tool, like technology, is one factor that influences their decision-making.

While this study showed that external factors, such as outcome expectancy, TTF, and social influence, impact teacher decision-making, internal factors also surfaced as an influence and confirmed findings from previous research. For example, teachers perceived an increase in engagement, creativity, and enthusiasm during the technology-based learning activities (Sáez-López et al., 2016). Another factor that teachers in this study mentioned was related to ICT saving them time. Uluyol and Şahin (2016) found that teacher performance and saving time were among the most frequent responses associated with personal factors that affect K-5 teachers' decision-making to have students use ICT. Another internal factor highlighted in this study that affects teacher decision-making was the perception of personal readiness with educational technology as

in Pavlovic, Stanisavljevic, and Soler-Adillon's (2016) study. Furthermore, Hatlevik (2017) concluded that teachers' perceptions of digital competence were a significant factor that influenced decision-making for students to use ICT. Teachers may not want students using a tool when they are unable to provide support due to their lack of familiarity with a particular resource.

The most frequent influence on teacher decision-making in this study was a factor called student technology readiness, which extended current empirical research. Clarke and Abbott (2016) noted that teachers were sensitive to the fine motor skills and dexterity needed in the use and care of devices like tablets and laptops and found that to be a consideration when students use ICT. Furthermore, Axford, Joosten, and Harris (2018) also stated that successful use of devices like iPads and other tablets require "precise finger placement, movement and speed and particularly control of the amount of pressure used" (p. 152). Furthermore, technology is what students are used to, and Pirani and Hussain (2019) noted that the teachers they interviewed also believe children prefer a more technology-rich learning environment and activities compared to the traditional style of learning.

Comparisons Among K-5 Teacher Decision-Making

Research Question 3 was: How does the decision-making process compare among K-5 teachers who use technology with students at varying levels of implementation? Key Finding 3 was the decision-making process among K-5 teachers who used technology at the redefinition level of implementation differed from those at the lower levels of implementation. The comparison among the decision-making process and K-5 teachers

whose students use technology at varying levels of implementation was distinct among those categorized in the substitution, augmentation, and modification groups. They were influenced most frequently by the student technology readiness theme, followed by the outcome expectancy, while the teachers in the redefinition category were influenced most frequently by TTF.

Elementary teachers have to factor in a variety of considerations when it comes to deciding whether to have their students use educational technology. This is an extension of current empirical research related to the topic. For instance, neither Davis (1989), nor Gu et al. (2013) included a factor such as student technology readiness in their model. Student technology readiness emerged as teachers referred to factors that neither model could account for. This finding extended what is currently known about decision-making in empirical research because no empirical research previously linked elementary teacher decision-making to student technology readiness based on motor skills and abilities to interface and navigate using educational technology.

Limitations of the Study

The limitations of this study were factors, influences, and circumstances that I could not control. In order to maximize transparency, I furnish several limitations that may have an impact on the outcome of this study. For instance, factors like research design, time, participants, and conceptual framework are all limitations that affect the trustworthiness and transferability of the findings of this study.

In this study, I used a generic qualitative research design, which according to Merriam and Tisdell (2016) and Patton (2015), may have unintended limitations. A

researcher who uses a generic qualitative research design may allow a bias to influence their interpretation of the data due to professional experience (Merriam & Tisdell, 2016). This concern was relevant in this study due to my role as a digital learning coach who helps to support the integration and student use of educational technology. In Chapter 3, I acknowledged this potential bias and described the strategies I used to mitigate it. For instance, in an effort to sustain and ensure credibility, I used the strategies of triangulation, respondent validation, seeking discrepant data, and submitting to peer review. Multiple interviews were used in which participants were interviewed at separate times to achieve triangulation and mitigate the limitations of time. After interviews were transcribed, participants were asked to validate the accuracy of the transcription, and all did so successfully without suggestions for edits. Using Gu et al.'s (2013) TAM and Puentedura's (2006) SAMR models for the development of a priori codes and as a guide for the interpretation of data led to the identification of discrepant data where a new code emerged. Student technology readiness is another factor that influences teacher decision-making.

Another limitation was related to the number of participants. In this study, saturation was achieved with the participation of 12 elementary teachers and second round interviews were only done with 4 out of the 12 participants. Conducting second round interviews with more participants may have generated additional data. If interviews had been conducted earlier in the year, there may have been more opportunity to recruit more participants.

Recommendations

My recommendations for further research are based on the study results and limitations of the study. The first recommendation is related to the first key finding and Research Question1, which was that K-5 teachers have students use ICT in the classroom most commonly at the substitution and augmentation levels of implementation. I recommend that studies be conducted where direct observation of elementary (i.e., K-5) students using technology can be used to determine if what teachers say they have students do is actually what is happening in the classroom. This may provide a deeper understanding of how primary students use educational technology for learning at various levels of integration and more data to achieve a higher degree of insight. In addition, it might be important for stakeholders to know how students use technology in one level of integration compared to another and what that looks like in various content areas and grade levels. The needs of kindergarten students are different from that of a student in Grade 5. Insight for supporting teacher and student needs as they seek to use ICT at various levels may be critical to a successful campus or district-wide technology roll out.

My second recommendation is related to the key finding linked to Research Question 2, which was that teacher decisions to have students use technology were influenced by all factors in the TAM but mostly by the emergent theme of student readiness. Future research could be carried out to explore how the TAM applies to primary and elementary grade-level teachers, specifically addressing student technology readiness. I recommend that research be conducted on how student technology readiness may affect teacher decision-making in various contexts. For instance, determining how

would student technology readiness affect a K-5 teachers' decision-making in a certain grade level or content area. Another recommendation would be for researchers to focus on student technology readiness and the effects of teacher gender, geographic location of the district, amount of teaching experience, or level of teacher technology readiness.

The third recommendation is related to the key finding linked to research question 3, which was that the decision-making process among K-5 teachers who used technology at the redefinition level of implementation differed from those at the lower levels of implementation. Since this study was one of the first to compare teachers' the SAMR model implementation level with what influences teacher decision-making, further exploration is needed to confirm or disconfirm the finding in this study. Of particular interest would be to see whether similar results related to higher frequency of influences of student technology readiness and outcome expectancy with teachers implementing at the lower levels of implementation, and TTF with teachers implementing at redefinition levels. Stakeholders might benefit from a deeper understanding of the potential effects that student technology readiness has on teachers, and whether this influence has the similar effect on secondary teachers.

In this study, student technology readiness was a perception that teachers had concerning the ability level at which students could operate and navigate educational technology. A recommendation for future research is to explore levels of readiness, and the degree that they exist in students. For instance, can student technology readiness be categorized by levels, and what characteristics would justify those levels?

The last recommendation is related to the limitations of this study. This study was done with 12 K-5 Grade teachers, in their classrooms, at their respective campuses. Therefore, this study should be replicated in a rural public school with teachers who teach elementary school children who have access to educational technology and have support through district digital learning coaches to determine if results are similar. Additionally, further insight into student use of technology at the higher SAMR model levels could be done with middle or high school teachers. Another recommendation is that future studies include a purposeful selection of participants with other criterion such as: specific number of years in teaching, teachers who teach bilingual classrooms, English as a second language students, special education students. Also, observations of how elementary students use educational technology at various level of integration might prove to be an excellent source of data in addition to interviews. An additional extension of this research is related to the framework used for this study. Future research could use Magana's T3 framework for innovation in education (2017, 2019) instead of the SAMR model. For instance, the T3 framework may be better suited for research that is focused on student-centered educational technology integration. Recent studies using metanalysis of several prominent technology acceptance models mention that most fall short of capturing the larger concept of technology acceptance in classroom integration (Scherer et al., 2019).

Implications

This study may contribute to positive social change in several ways. First the research may help to creating deeper understanding of the decision-making process of

teachers, which will positively affect student engagement, academic growth, and lay the foundations for technology literacy for students. There is also potential for change at the district level. For instance, knowing more about how teacher decision-making is influenced by student technology readiness could potentially provide a more comprehensive and successful integration of educational technology. If stakeholders understood that kindergarten students have difficulty operating a Chromebook due to an emergent literacy and limited fine motor skills, they may choose to integrate a tablet instead.

In relation to advancing knowledge in the field, this research can help with improving practice, and possibly encouraging stakeholders such as central administrators, campus administrators, instructional coordinators, and coaches to use the findings from this study to better understand the factors that influence teacher technology implementation decisions, so districts can foster environments in which teachers are more likely to implement technology with young students. Specifically, this study found that the decision-making process of teachers to implement student technology needs further exploration, specifically related to how teachers view student technology readiness. Also, it is important to determine when a student should receive specific technology training to develop their skills. Furthermore, which grade level should be responsible for each subsequent skill development as appropriate based on such factors as motor skill development. Ultimately, more research is needed where the focus of teachers' decision-making is on how students will use technology and not the teachers themselves.

Implications for practice include how the results of this study may inform districts for strengthening support of the decision-making process of teachers, how teachers can better understand the influences that shape their decision-making, and how all of these may impact students as a result of improved practice. Districts who seek to support best practices incorporating educational technology may benefit from the findings of this study. A district organization should seek to creating an environment where teachers are less likely to encounter frustration due to factors like an unstable internet infrastructure, outdated technology, software and hardware that is not age or grade level appropriate for student development. If given the opportunity to choose devices and software for classroom and student applications, a well-informed teacher may request software or hardware that is more appropriate from their students so they can spend less time troubleshooting and more time teaching content. Also, knowing that teachers are influenced by peers, districts could give teachers release time to observe technology innovators. Students may benefit from all other stakeholders being more informed by the results of this study because they may be able to learn in a classroom where current technology is appropriate for their development. Students can connect to internet resources quickly and regularly to access software that allow them to engage in grade level appropriate activities to support their learning.

Conclusion

The problem related to this study is that, while technology literacy is a key skill needed for student success in today's world, little is understood about the decision-making process of K-5 teachers as it relates to students use of ICT and varying levels of

implementation. The key findings for this qualitative study was that teachers have students use ICT in the classroom most commonly at the lower enhancement levels of implementation. Teacher decisions were influenced by all the factors in the TAM, but mostly by the emergent theme of student technology readiness. When comparing the decision-making process among K-5 teachers who used technology at the redefinition level of implementation differed from those at the lower level of implementation. This may have been the case due to teachers' perceptions of elementary students' technology readiness to physically use hardware and then navigate software. The teachers in the redefinition category are teachers of Grades 4 and 5, whereas most other teacher participants taught in the lower grades and may have been influenced by the perception of lower levels of student technology readiness.

Districts invest a significant portion of their budget to acquire and sustain educational technology. Empirical research indicates that there is an academic benefit when students are able to use educational technology with best practices (Hamilton-Hankins, 2017). This study contributes to positive social change by informing educational stakeholder about ways they can better support the process of education as it relates to the integration of educational technology. The more that is understood about how students learn and use educational technology, and teacher decision-making to have students use ICT, more frequent opportunities are possible to improve student technology literacy skills so that they can become the next generation of innovators who are well prepared to adapt to an ever changing climate of a technologically infused society.

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Appendix A: Code Book for SAMR A Priori Codes

a priori codes	Content Description (with citations)	Inclusion Criteria
Substitution	ICT use in this level of the model is characterized by technology acting as a direct substitute for another tool, with little to no functional change (Cherner & Smith, 2017; Puentedura, 2013).	Students take digital notes or writing/word processing, replaces paper/essay, Students create digital presentations replacing paper posters Students have access and ability to view images/graphics, input simple response into online form or word processing document Students can capture images with camera or screen capture. Students can access and listen to audio players of music, or voice recordings Student can manipulate digitally rendered objects, and read digitally rendered textbooks
Augmentation	Use of ICT at the augmentation level is defined as technology use that acts as a direct substitute, with functional improvement for an activity (Cherner & Smith, 2017; Puentedura, 2013).	View a video any number of times, any place or location as opposed to a student not having access or control of the video Students can access online interactive content that is not just static but can be changed, create images or graphics, word processing that can be shared
Modification	Task modification with ICT is defined as a use of technology which allows for a significant redesign of an educational activity (Cherner & Smith, 2017; Puentedura, 2013).	Creating multimedia presentations to demonstrate knowledge and understanding of a unit or skill using sound, text, images, and video Remote video conferencing to discuss or explore content Digital story-telling for reflection or demonstration of knowledge from the perspective of the student Digital gamification for mastery, growth and achievement in learning content that may include individual, local, or worldwide competition

Redefinition	Redefinition, the highest level of the SAMR model, is defined as technology that allows for the creation of new tasks that could not have been done without the use of technology (Cherner & Smith, 2017; Puentedura, 2013).	Virtual Field trips to explore locations and environments that are physically inaccessible. Augmented reality for students to explore objects, people and places rendered digitally in 3D Authentic learning environments where students engage with public figures, experts and practitioners in the field Real time collaboration and information sharing locally and remotely with other students, teachers worldwide

Appendix B: Code Book for TAM A Priori Codes

a priori codes	Content Description (with citations)	Inclusion Criteria
Outcome Expectancy	Outcome expectancy has been addressed as perceived usefulness, ease of use, relative advantage, and performance expectancy in other technology acceptance models (Davis, 1989; Venkatesh et al., 2003).	Technology benefits students (or doesn't benefit them) Technology was easy to use (or not easy to use) Technology helped to improve teaching/learning (or didn't)
Task-Technology Fit	TTF has also been addressed as effort expectancy, when ICT meets the task needs of the teacher or student and has a positive impact on learning or teaching (Gu et al., 2013). One of the ways that TTF is perceived by teachers is whether ICT will have a positive impact by increasing teacher performance.	Teacher describes technology that did or did not have an impact on learning Age of the application was (in)appropriate Assist in teacher's professional performance Saved time, or increased time on task Students didn't respond the way I thought they would to the ICT
Social Influence	Gu et al. (2013) suggested that the social influence construct in technology acceptance is a teacher's perception that a person or organization want them to use ICT. Teachers on a campus may experience a kind of social pressure which impels them to use technology (Gu et al., 2013). Social influence includes such stimuli as information and observation from other teachers and students (van Deursen et al., 2016).	Campus, department, grade level, team, is using/not using technology, so I am too Recommended or discouraged form a colleague within the district Suggestion or recommendation from professional learning network outside district Policy or larger organization requires the use
Personal Factors	Personal factors, also described as perceived self-efficacy, readiness, or technology comfort in other studies, account for the greatest statistical significance relating to K-5 teacher decision-making (Gu et al., 2013). Factors such as self-efficacy, personal effort expectancy, personal innovativeness, emotional influences, preconceived notions, and current	I enjoy/do not enjoy trying new things, being innovative Personal preference for version, maker, model of technology I am/ am not ready to use technology Technology is/is not fun and engaging

	perceptions of ICT all seem to play a large role in this element of technology acceptance.	I use technology for the sake of my students' academic growth and achievement Need to impress or attempt to gain external recognition or award
Student Technology Readiness (STR)	Student technology readiness entails the current ability or skill level that a student possesses which allows them to operate hardware or navigate or interface within software programs.	Student ability to use technology Student readiness to logon navigate and successfully produce a digital object
	Lack of prerequisite skill	Student can or cannot log on to a device Student can or cannot operate a computer or device Student can or cannot interface with the app or software program Student digital citizenship
	Classroom expectations Lack of efficiency	Teacher/student trust to use technology Technology will take too long to teach and will not result in a timely outcome
	Supposition of eventual student technology readiness	Teacher will teach prerequisite skills due to value of using technology
	Academic limitations preventing ICT use	Lack of literacy prevents use of technology
	Digital Natives	Technology is what students are used to using

Appendix C: Code Book for Emergent Themes in Level 2 Analysis

	Emergent Theme	Inclusion Criteria
Substitution	Technology for a digital option, or to replaces paper/pencil	Simple learning activities that could be substituted for a paper/pencil activity
	Technology is used for students to use word processing	Students will use a word processing program to type words or sentences.
	Technology is used for students to create digital images	Technology is used for a basic camera or image capture function.
Augmentation	Technology used for students to have access to online interactive content	Students access digital resources that may or may not be available otherwise.
	Improve student synchronous/asynchronous collaboration	Technology is used to generate a collaborative environment that is live or asynchronous, remote or local.
Modification	Students use technology to create multimedia to express their learning,	Technology is used to allow for the creation of presentations or projects that include graphics, sound, video, images, and text.
	Students practice skills with software that provides a gamification learning style	Technology includes a digital/online activity where students can learn and interact in a game style environment.
Redefinition	Student used Virtual or augmented reality to overcome barriers to learning like location, time, and cost.	Technology allows for students to view, and experience environments and locations that are otherwise challenging or impossible to explore due to cost, location, or time.
	Students use adaptive software that changes rigor of activities and tasks based on interactions and input from students while actively engaged in the program.	Adaptive software.
Student Technology Readiness (STR)	Student technology readiness entails the current ability or skill level that a student possesses which allows them to operate hardware or navigate or interface within software programs.	Student ability to use technology Student readiness to logon navigate and successfully produce a digital object
	Lack of prerequisite skill	

		Student can or cannot log on to a device
		Student can or cannot operate a computer or device
		Student can or cannot interface with the app or software program
		Student digital citizenship
	Classroom expectations Lack of efficiency	
		Teacher/student trust to use technology Technology will take too long to teach and will not result in a timely outcome
	Supposition of eventual student technology readiness	
		Teacher will teach prerequisite skills due to value of using technology
	Academic limitations preventing ICT use	
		Lack of literacy prevents use of technology
	Digital Natives	
		Technology is what students are used to using
Outcome Expectancy	Technology to assist in learning	Technology for building student autonomy, or improving achievement
	Increase student engagement in learning	Technology to integrate student interests, or to create an authentic audience
	Technology to improve learning process	Technology increases student ownership of learning, or for Skill building, or to build a digital portfolio
Task-Technology Fit	Technology assists in informing instruction	Technology helps to inform teacher and student with data
	Supports pedagogical practices	Technology used, or Assists teacher to overcome barriers in student education, or Academic intervention, or Differentiation
	Supports workflow/productivity with students	Teachers and students can more easily manage assignments and grading.

Social Influence	Environmental	Teacher perceives a need for more devices
	Peer pressure	Teachers feel pressure to use technology from colleagues who use technology
	Professional learning network	Obtaining ideas from other professional on social media, or conferences
	Academic performance pressure	Teachers are encouraged/discouraged from using due to academic performance expectations
	Technology reliability	Teachers are encouraged/discouraged to use technology based on the perceived notion of network or device reliability
Personal Factors	Novelty	Technology to try interesting approaches for student learning
	Personal preference	Teacher will choose technology that they prefer
	Teacher Self-efficacy with technology	Teachers' perception of sufficient experience and ability to use technology effectively
	Ease of use of technology	Technology is easy to use
	Digital Citizenship	Student digital citizenship is a factor influencing decision to use technology.