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Perceptions of Veteran Middle and High School STEM Teachers on Integrating Tablets into the Classroom

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This is to certify that the doctoral dissertation by

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Despite the availability of technology for instruction, veteran science, technology, engineering, and mathematics (STEM) teachers are still reluctant to incorporate recent technologies, such as tablets, into the classroom. This qualitative case study was conducted to explore the perceptions of eight middle and high school veteran STEM teachers integrating tablets into the classroom. This study focused on how veteran STEM teachers viewed the integration of tablets into the school, the challenges experienced when integrating tablets into the classroom, and the opportunities that experienced STEM teachers observed when integrating tablets into the classroom based on the technological pedagogical content knowledge (TPACK) conceptual framework. The data were collected through teachers' technology-infused lesson plan paradigms, semi-structured telephone interviews, and Zoom audio-recorded interviews. Four female participants, Grades 8, 10, and 12, were in the United States, and three male and one female participant, Grades 10 and 12, were in the UAE. The study found that teachers perceived several challenges and opportunities when using tablets in the classroom. Additionally, the results indicated a lack of training and support for teachers. Even though a comprehensive understanding of how some technology teachers use these tools to plan and implement instruction, the number of tablets used by veteran middle and high school STEM teachers still needs to be improved. As a result of this study, the problems caused by a lack of tablet use in the classroom have been identified as well as solutions and opportunities to promote social change.

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Dedication

This is a tribute to my youngest son, who was killed by a car at 14. I am grateful for his encouragement and inspiration. May he rest in peace. A heartfelt thank you for all those years. It was an honor to know him.

Acknowledgments

Thanks to my chair and mentor, Dr. Heng-Yu Ku, I learned the meaning of being a professional scholar through his encouragement, feedback, and patience. During his off time, he answered my emails despite my interruptions. Everything had to be perfect before he accepted my work, and I learned so much as I strived to produce quality work worthy of his approval. I am also incredibly grateful to Dr. Ku for showing me a path out of the darkness during tough times. Dr. Caldwell, thank you for being such an outstanding team member. I appreciate the guidance and patience received by Dr. Arome. Thanks for coming aboard and providing inspirational feedback. Thank you so much to Dr. Harland for helping me enhance my design skills. I want to acknowledge that Jennifer Krou has been my writing tutor for many years.

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Chapter 1: Introduction to Study

Middle and high school technology teachers often use technology to encourage student participation in their classrooms equipped with technology. For example, iPads have often been used by technology teachers to improve pedagogy and lesson content (Craciun, 2019; Jiang et al., 2017; Pattillath et al., 2018). But there is a need to explain how technology, such as tablets, can be integrated into instruction (Alavi et al., 2016; Albion et al., 2015; Dooley et al., 2016; Jiang et al., 2017; Starkey, 2020). Classroom teachers are often underequipped to use technology effectively in their subject areas to enhance their teaching and improve student's learning (Starkey, 2020; Wijaya & Djasmeini, 2017). Many classroom teachers use traditional instruction to teach students how to take notes from blackboards and whiteboards (Wijaya & Djasmeini, 2017), but students may not be able to participate in class actions and perform at their best (Starkey, 2020). Research is needed to present more information on how veteran middle and high school technology teachers integrated tools to enhance pedagogy and content (Hoffmann & Ramirez, 2018). Al-Abdullatif et al., 2019; Mustafina, 2016).

The purpose of this qualitative case study was to explore the perceptions of eight middle and high school grade veteran STEM teachers integrating tablets into the classroom through the lens of the TPACK model and improve the integration of tablets in the school based on their feedback through interviews and documents. By understanding how to use these tablets for expanding and enhancing instruction and learning, administrators, classroom teachers, and students will benefit from the findings of this

research study. This chapter provides background information about educational technology knowledge areas and a brief overview of the perceptions, challenges, and benefits of using tablets in the classroom. I will discuss the major sections in this chapter. The background and problem statement discussing veteran middle and high school STEM teachers and their challenges when integrating tablets into the classroom will be first. The purpose of the study, nature, and research questions define the investigation of veteran STEM teachers' perceptions of integrating tablets into the classroom. Next, the Technological Pedagogical Content Knowledge (TPACK) provides the theoretical framework. Finally, definitions, assumptions, scope, delimitations, and limitations of the terms used in the study are provided.

Background

There is a high interest in science, technology, engineering, and math (STEM), but schools struggle to engage teachers. STEM education can increase student learning, engagement, and inspiration and provides a range of career opportunities (Lynch et al., 2018). However, with technologies continuously growing, teachers and administrators must understand the needed improvements in how educators and students use technology in the classroom (Pepe, 2016). Teacher perceptions and beliefs are barriers that play an essential role in integrating technology into the classroom. Teacher resistance to change frequently weakens successful educational reform (Fong et al., 2015). For example, some teachers' attitudes toward tablets diminished after one year of use (Sahin et al., 2016).

Technology is known for its impact on learning (Domingo & Gargante, 2016). But there is a need for more integrated tablet technology in teacher preparation (Jordan et al., 2016). Teachers incorporating tablets into teaching and learning presented challenges (O'Connor et al., 2018). Educators must provide a learning environment allowing problem-solving as students develop their content knowledge (Margot & Kettler, 2019). STEM educators should have chances to enrich their perceptions and understandings of the advantages of using tablets in the classroom. Using technology offers many opportunities for STEM teachers to nurture authentic learning experiences. To improve students' learning experiences and educators' performance, educators need to be proactive in implementing tablets into pedagogy and content (Engeness & Edwards, 2016). Technology teachers might practice ways to use tablets (Hoffmann & Ramirez, 2018). With a realistic learning environment and plenty of resources, students can expand their understanding of society by channeling innovative learning into their future jobs (Siefert et al., 2019).

The researcher discovered a gap in this study since the impact of technology integration in the classroom was researched more, and less was studied about teacher perceptions of its use in classrooms; a gap exists that indicated a need for my study (Domingo & Gargante, 2016). The gap in the literature is an indication that this study is needed. This qualitative case study explored veteran middle and high school STEM teachers' perceptions of integrating tablets into classroom instruction to enhance teaching and learning. STEM teachers are essential when it comes to students' development.

Therefore, awareness of their perceptions and beliefs is necessary because these ideas can influence instruction.

Problem Statement

Some teachers do not effectively use tablets to engage students in learning experiences, which does not improve student performance and academic ability (Tseng, 2018). Despite the technology available for instruction in the classroom, some veteran middle and high school STEM teachers are reluctant to integrate tools such as tablets into their curriculum. This was because some teachers needed knowledge, training, and strategies for using them (Aflalo et al., 2018; Thompson, 2015; Voogt & McKenney, 2017). Many teachers still lack a basic understanding of using tablets (Kale, 2018). Thus, veteran teachers face many challenges when integrating new teaching practices and learning methods, especially educational technology. But a gap in the literature exists regarding teacher perceptions of integrating tablets into the classroom (Demirbas & Timur-Ogut, 2020; Domingo & Gargante, 2016).

Purpose of the Study

This qualitative research study was intended to explore the perceptions of eight middle and high school veteran STEM teachers integrating tablet technology into the classroom. The goal was to enhance the teaching practices and learning skills of students. To meet 21st-century educational challenges, educators must integrate technology effectively (de Silva et al., 2016). Using technology as a tool for enhancing teachers' technical competencies and improving students' learning is one of the core

responsibilities of classroom teachers (Kirikcilar & Yildiz, 2018). Teachers should learn how to integrate tablets into their classrooms to ensure proper use (Montebello, 2017). Therefore, I explored veteran middle and high school STEM teachers' perceptions of integrating tablets into the classroom through the lens of the TPACK model.

Research Questions

RQ 1: How do veteran middle and high school STEM teachers perceive the process of integrating tablets into the classroom?

RQ 2: What challenges do veteran middle and high school STEM teachers observe when integrating tablets into the classroom?

RQ 3: What opportunities do veteran middle and high school STEM teachers observe when integrating tablets into the classroom?

Theoretical Framework

The theoretical framework for this study is the TPACK model, which addresses seven characteristics for teachers to use when successfully integrating technology into the classroom (Angeli et al., 2016). The TPACK framework was formulated by Koehler and Mishra (2009), which extends Shulman’s (1987) pedagogy content knowledge (PCK). Understanding technology is related to knowledge of content and knowledge of pedagogy in diverse ways. TPACK is a framework for understanding how technology is used to support learning in both pedagogy and content (Feride, 2015; Lehiste, 2015; Lin et al., 2015; Sheffield & Dobozy et al., 2015). Teachers might be able to comprehend technology integration with the help of the TPACK lens (Dong et al., 2015; Pamuk et al.,

2015). The TPACK framework describes the knowledge teachers need to effectively integrate technology into the classroom (Koehler & Mishra, 2015). The TPACK framework was appropriate for this research because it describes how veteran teachers must incorporate technology into the classroom. TPACK model proposes the characteristics teachers need to know about technology by rejoining technology to subject matter and teacher pedagogical understanding (Koehler & Mishra, 2015). The best practices for integrating technology into instruction can be shared by educators familiar with the TPACK framework (Millen & Gable, 2016; Mishra, 2014). TPACK provided a lens for understanding more about integrating technology into teaching and improving the quality of 21st-century education (Xiong & Lim, 2015). In Chapter 2, I will provide a more detailed explanation of how TPACK relates to this study approach and research questions.

Nature of the Study

The nature of this study is a qualitative case study. A qualitative research study is used to explore how people cope in real-world settings (Patton, 2015; Yin, 2016), which is the focus of this study on how eight veteran teachers integrate tablets into their classrooms and what their perceptions are when confronted with different challenges and opportunities naturally occurring in the school. As with other qualitative methods, this qualitative approach was not restricted to one methodology for data collection (Kahlke, 2014). Data were gathered through a semi structured telephone interview, a Zoom audio-recorded interview, and teacher technology-infused lesson plans. In semi-structured

interviews, candidates provided examples of how tablets had been integrated into instruction and told their experiences. Each candidate permitted me to record the discussion. Data patterns were analyzed to find similarities and differences between research questions. Data patterns were identified for the SQ1, SQ2, and SQ3 interview questions.

Definitions

21st-century skills: A student who wants to succeed in college and beyond needs life skills, the ability to learn, and the ability to use technology (Vasil, 2020, p. 46).

Content knowledge: Teacher content knowledge, or subject matter understanding, refers to the ability to comprehend the subject matter the teacher teaches (Scherer et al., 2017).

Digital immigrants: For this study, those interacting with modern technologies later in their lives (Salomon, 2014).

Instructional gap: In this study, a teacher instructional gap refers to poor classroom practices with tablets and inefficient use of technology in 21st-century learning and teaching (Yaki & Babagana, 2016).

Integration of technology: To integrate digital tools into teaching and learning, teachers are asked to provide ideas that match learning objectives and facilitate instruction (Scherer et al., 2017). The effective integration of technologies occurs when students can select technology tools that will assist them in obtaining information

promptly while analyzing and synthesizing the data and presenting it professionally (ISTE, 2015).

Integration process: As part of the integration process, teachers' ideas match learning objectives, facilitate instruction, and find viable solutions to teaching and learning with technology tools (Scherer et al., 2017).

Pedagogy content knowledge: Describes strategies to deliver subject matter by connecting content knowledge and pedagogical knowledge (Scherer et al., 2017).

Pedagogy knowledge: To direct instruction and structure their curriculum, teachers need to know the teaching requirements, principles, and methods (Scherer et al., 2017).

Perceptions: For this study, perceptions were motivated by past experiences, memories, expectations, suggestions, and the context in which any given expertise occurs (Spaulding, 2015).

Professional development: Improves teachers' knowledge and skills (El Shaban & Egbert, 2018; Greene & Jones, 2020).

Social media: For this study, a group of networks provides opportunities for teachers to connect with groups and pages relevant to their profession. Facebook is the most popular site (Boholano, 2017).

Tablets: For this study, a mobile device can be used anywhere/anytime, highly motivating, and as a tool to scaffold learning. It also provides a touchscreen for direct manipulation (Blackwell, 2014).

Technology content knowledge: Whether and how technology can be used to communicate better and teach subject content (Scherer et al., 2017).

Technology integration: In classrooms, technology supports and strengthens instruction (Liu et al., 2017).

Technology knowledge: A key element is using conventional and digital technologies to enhance instruction (Scherer et al., 2017).

Technology teachers. A technology teacher is a professional educator who teaches courses and activities related to technology. A significant focus is placed on developing the staff's technical abilities and skill sets for using technology tools in the classroom (Roland, 2015). In this study, some teachers do not have classroom or laboratory experience with tablets.

Technology: This study uses tablets in the classroom to support teaching and learning (Thompson, 2015).

Veteran teacher: For this study, a veteran teacher is an experienced teacher who has taught for more than five years (McAtee, 2015).

Assumptions

Research premises are established on innovative ideas and concepts (Winterhalder, 2017). Therefore, the following assumptions were necessary for the context of this study since they cannot be demonstrated to be true. I assumed that the study participants were veteran STEM teachers in middle and high schools who integrated tablets into their instruction to enhance teacher practices and student learning

skills. I assumed that candidates use tablets in unique and meaningful ways to strengthen and expand students' learning. Furthermore, I expected the candidates to share their perceptions and knowledge with me. I assumed that candidates would provide accurate and transparent responses to the research questions and that the participants were honest and sincere about their participation in the study with no other motives involved.

Scope and Delimitations

The study's scope comprised attaining veteran middle and high school STEM teachers' perceptions of integrating tablets into the classroom. The range also included an evaluation of teacher artifacts such as a lesson plan. The conditions for participation in this study were that the eight selected veteran middle and high school STEM teachers had access to tablets and some knowledge or interest in integrating them into classroom instruction. In this research study, teachers adjusted their schedules to incorporate teaching and learning skills during the COVID-19 pandemic. These changes may enable future studies on online education and learning.

This qualitative case study aimed to explore eight veteran middle and high school STEM teachers' perceptions of the integration of tablets into the classroom through the lens of the TPACK model. The TPACK model proved to be a valuable lens for examining the development of in-service teachers, especially regarding its meaningful integration to transform practice (Archambault, 2016). Veteran teachers may have been reluctant to integrate technology into the classroom due to negative perceptions limiting the results from being transferred from one context to another. Transferability is a means

of making research results helpful in other contexts (Leavy, 2017). Dependability was ensured through triangulation of the data to address the limitations.

Limitations

This study was limited to teachers fitting the benchmarks of veteran middle and high school STEM teachers. The data collected in this qualitative study was also limited to eight teachers. Thus, a limitation was the small sample size and the use of convenience sampling. But there are no rules for sample size in qualitative inquiry, and small in-depth samples have led to some essential breakthroughs (Patton, 2015). During convenience sampling, participants are chosen based on their ease of availability. The small sample size could have influenced bias, but with purposeful random sampling, "even small samples substantially increase the results' credibility" (Patton, 2015, p. 286). Based on eight participants, the credibility of random sampling was greater (see Patton, 2015). Another limitation may have been the limited perceptions of the TPACK characteristics required by teachers to be successful in enhancing teacher perceptions. Lastly, the study was limited to a semi-structured telephone interview, an audio-recorded Zoom interview, and teacher artifacts with purposeful random sampling.

Significance

The outcomes of this study provided an understanding of veteran middle and high school STEM teachers' perceptions of integrating tablets into the classroom. This study expanded on previous research on the effective integration of technology in the school (Domingo & Gargante, 2016). Teacher perceptions are essential and can interfere with

the efficient use of technology. Attitudes provide insight into teachers' beliefs and efforts, such as educational research organizations and school districts providing short-term support, guidance, and professional development. Still, federal funding is limited (Thompson, 2015). This short-term support has left some veteran teachers concerned about maintaining adequate technological development for students in the classroom, and some teachers have been unprepared to integrate technology (Thompson, 2015).

I found nothing in the literature about teacher perceptions of integrating tablets into the school (Domingo & Gargante, 2016). Despite the numerous ways technology devices were used in education, there was a gap in the literature (Hoffmann & Ramirez, 2018). The research gap required a more thorough understanding of how these tools could be integrated and a clear description of the process (Hoffmann & Ramirez, 2018). This research can potentially influence professional development for veteran teachers regarding tablets in the classroom. Examining personal perceptions in this study may lead to broader use of tablets in the school. Recent findings indicated that 76% of students reported studying technology in mathematics, science, social studies, or history (National Assessment of Educational Progress, 2017; Prince, 2017). This research could influence professional development for veteran teachers regarding tablets in the classroom. This study's examination of personal perceptions may lead to the broader use of tablets in schools. Classroom teachers could benefit from the shared knowledge of these eight veterans STEM teachers, but students will benefit from tablet-based education. One of

the most significant benefits of this study was that veteran STEM teachers were better able to use these devices to expand students' learning and promote positive social change.

Summary

Veteran middle and high school STEM teachers may experience altered instructional roles, serving as facilitators for students using tablets to promote active learning and class participation. According to the literature review, more information needs to be written about how these tools are used in instruction. Tablet use in the classroom is necessary to improve education and a better understanding of the device (Bodsworth & Goodyear, 2017; de Silva et al., 2016; Geiger et al., 2015; Koh et al., 2015; Lee & Kim, 2014). The major components of the study were discussed in this chapter: the background and the problem statement, the purpose of the study, the nature of the study, and the research questions. The definitions, assumptions, scope, delimitations, and limitations were also discussed. The significance of the study discussed the general contributions and their importance to the study. A review of the literature is presented in Chapter 2. Several methods of using tablets in teaching are presented in the literature review.

Chapter 2: Literature Review

Despite the availability of technology for instruction, some middle and high school veteran STEM teachers have been reluctant to integrate tools such as tablets into their curriculum. Some teachers stated they were unprepared to integrate technology into the classroom (Thompson, 2015), which is not preparing students for workforce demands (Flore, 2017; Graesser, 2017; Greiff, 2017; Griffin, 2017; Gong, 2017; Kyllonen, 2017; Massey, 2017; O'Neil, 2017; Pellegrino, 2017; Rothman, 2017; Soule' & von Davier, 2017). Rapid technological transformations are reforming life and work while redefining and reprioritizing skills that employees and citizens must have to succeed (Fiore et al., 2017).

The literature review provided information regarding the knowledge needed to integrate technology into the classroom. In this review, research was highlighted in the following three research questions:

1. How did veteran STEM teachers perceive the process of integrating tablets into the classroom?
2. What challenges did veteran middle and high school STEM teachers observe while integrating tablets into the classroom?
3. What opportunities did veteran middle and high school STEM teachers observe when integrating tablets into the classroom?

This study provided information about the current classroom use of tablet technology. The study also listed veteran teachers' challenges when using tablets in school. The study

focused on teaching opportunities with tablet integration and teachers' perceptions of integrating technology into the classroom.

Literature Search Strategy

To conduct the literature review, I used the Walden University library to retrieve literature on veteran STEM teachers' perceptions of integrating tablets in the classroom. Peer-reviewed articles, dissertations, and books were gathered from the Educational Resource Information Center (ERIC), Online Journal of Technology and Teacher Education (JTATE), International Society for Technology in Education (ISTE), Walden University Library, Elton Bryson Stephens Company EBSCO, and ProQuest databases. Key search terms and combinations used in all databases and search engines included the following:

- The integration of tablets into the classroom,
- Teacher experience with tablets in the classroom,
- Using tablets in school,
- Veteran teachers' perceptions of tablet technology integration into the classroom,
- STEM education,
- Veteran high school STEM teachers' perceptions of integrating modern technologies into the classroom,
- Teachers' use of recent technologies in the classroom,
- Technology integration and the TPACK model,

- What is the TPACK model?
- Teachers' use of the TPACK model for professional development.

Additionally, I conducted Internet searches to explore integrating tablets in the classroom based on the authors and titles retrieved other sources. There was a shortage of literature on perceptions of veteran teachers integrating technology into the school; therefore, I relied on books, dissertations, journals, and conference proceedings. Several themes emerged from the literature review: more choices, meaningful learning, reinforcement, consolidated workload, motivating, safe use, functionality, student issues, teacher issues, enhanced teaching practices, self-directed learning, ease of use, and collaboration.

Theoretical Foundation

Technological, Pedagogical, and Content Knowledge (TPACK) is defined as the knowledge needed by teachers to teach using technology efficiently. The origin and source of the theory were Koehler and Mishra (2015). TPACK is a teacher knowledge framework for technology integration that builds on Shulman's (1986, 1987) pedagogical content knowledge to include technology knowledge. Six knowledge domains exist in the TPACK framework:

- Technological knowledge: the depth and breadth of understanding of technologies (new and old) for use in educational contexts,
- Pedagogical knowledge: the depth and breadth of knowledge about a variety of instructional practices, strategies, and methods to promote students' learning,

- Content knowledge: the depth and breadth of understanding about the ideas, topics, or subject-matter knowledge that a teacher is planning to teach to students,
- Pedagogical content knowledge: Shulman's idea of the understanding needed to teach subject matter, including an understanding of assessment, common misconceptions, and adapting instruction to diverse learners in the specific subject matter,
- Technological content knowledge: An understanding of the reciprocal relationship between technology and content; for example, what they teach is often defined and constrained by technologies and their symbolic and functional capabilities-accordingly,
- Technological pedagogical knowledge: An understanding of technology and pedagogical practices, which can, and should, constrain and afford one another. (Herring et al., 2016, p. 4)

The six domains exist in two types: the base domains (TK, PK, and CK) and the hybrid domains (PCK, TCK, and TPK). This seventh domain goes beyond all three core mechanisms to prompt meaningful and profoundly skilled teaching (Kimmons, 2015).

Using the TPACK framework provided insight into STEM teachers' perceptions of integrating tablets into the classroom. The TPACK framework describes teachers' knowledge to effectively integrate technology into the classroom (Herring et al., 2016; Smith, 2015). The model thus provided a theoretical lens that defined the body of

knowledge that veteran middle and high school STEM teachers needed to teach with and about tablet technology used in their assigned grade levels (Niess, 2016). The model supported the current study's purpose to explore veteran teachers' perceptions of integrating tablets into the classroom through the lens of the TPACK model to enhance practices and training components.

Previous research has supported that TPACK is essential for enabling teachers to integrate technologies into their teaching practices. Voogt and McKenney (2017) examined how five teacher education institutes (TEIs) assisted in developing the necessary technological pedagogical content and knowledge to use technology effectively. They sought to understand if and how TEIs' integrated technology for nurturing early literacy in their curriculum helped develop prospective students' TPACK in early literacy. The findings indicated that TEIs hardly taught technology, and their current structures and habits were not conducive to developing TPACK. Integrating technology into educational practice is a complex innovation for teachers, and teachers have anxiety when incorporating technology into their instructional methods (Voogt & McKenney, 2017). Teachers may also be reluctant to use technology primarily because of negative perceptions and little to no training, resulting in a lack of confidence in using the available technology (Starr, 2015).

Literature Review Related to Key Concepts

A literature review of middle and high school STEM teachers integrating tablets into instruction identified the following concepts:

- Benefits of tablet use in the classroom
- Integrating tablets into instruction
- Challenges and risks in integrating tablets
- Social media

Benefits of Tablet Use in the Classroom

Tablet inclusion in middle and high school instruction has been found to provide several benefits, with researchers noting that tablets help to learn in many ways (Cabus et al., 2017). Internet access has made mobile technology ubiquitous and enables students to continue learning after class (Sousa et al., 2017). Pedagogy strategies and complex learning materials can be enabled by technology tools such as the Internet, apps, websites, networks, iPads, desktop computers, and laptops (Aflalo et al., 2018). But to integrate tablets into teaching effectively, teachers must understand the benefits of the tools (Koehler et al., 2017), such as enabling them to transform their instructional practices (Aflalo et al., 2018) and customize the education of their students and take responsibility for it (Sousa et al., 2017). As a result of increasing their use of tablet technology, teachers may need to learn more relevant content, apply concepts to various applications, and solve problems (Aflalo et al., 2018).

Integrating Tablets into Instruction

Using tablets in schools improves and facilitates more flexible learning opportunities inside and outside the classroom. Incorporating tablets into teaching has enabled several applications that improved teachers' teaching and learning experience

(Kale, 2018). But for students to receive help from these tools, teachers must understand the services and practices (Kale, 2018). Teachers need to learn how to fix Internet connections, promoting teacher-centered instruction to prevent losing class time (Yagci, 2015). To help students develop competency using tablets, teachers also need to understand students' social learning styles.

With tablets like iPads becoming more familiar to teachers and students (Hutchison & Colwell, 2015), iPads can be successfully integrated into instructional programs so that students can participate in interactive learning (Flewitt et al., 2015). Using iPads in teaching allows students to tell stories using multiple forms of media (Hutchison & Colwell, 2015). Recording students telling stories and converting them to digital format for playback and correction are two benefits of using the iPad. Students also can access Internet applications and programs for educational purposes with their teachers' guidance through another version of the iPad 2. iPad 2 allows step-by-step instructions with versatile digital controls, and the iPad 2 has features that make interactive learning possible for students with severe learning disabilities because it produces auditory cues, text, and pictures (Spooner et al., 2015). Through iPad apps, students have access to multimodal programs that offer interactive learning suitable for addressing various learning styles (Flewitt et al., 2015).

Given that mobile technology has permeated all aspects of everyday life, there is a growing need to purposely use tablets when educating 21st-century students to meet their digital learning needs. Modern youth are familiarized with technology at an increasingly

younger age (Jordan et al., 2016). Mobile tools such as tablets allow a more flexible learning environment while enabling teachers to scaffold many students (Sahin et al., 2016). There is a need for more integrated tablet technology in teacher preparation. There is also a need to incorporate digital tools, such as wearables, to support teacher development (Chenowith & Ferdig, 2016).

Challenges and Risks in Integrating Tablets

In studies exploring the challenges and risks of integrating tablets into instruction, researchers found that teachers' perceptions and training were impacted by these difficulties (Bodsworth & Goodyear, 2017; Dooley et al., 2016; Ghavifekr & Rosdy, 2015; Voogt & McKenny, 2017). Various challenges affect the implementation of tablet use, including limited infrastructure, inconsistent school policies, broken equipment, and stakeholder input (Ghavifekr & Rosdy, 2015; Mayes et al., 2015). These devices presented significant obstacles for classroom teachers when trying to deliver lessons. Using these tools, students have met their learning needs while participating in meaningful instructional practices with teachers (Mayes et al., 2015). In Raji and Zualkernan (2016), it was found that teachers, principals, and stakeholders needed to be trained in using tablet technology to improve education. Tablets should be used to enhance classroom instruction in the present as well as be sustainable in the future. According to Dalal et al. (2017), teachers lacked the necessary skills to integrate tablet technology into instruction, regardless of their knowledge and abilities.

Training veteran teachers on pedagogy and tablet content could affect 21st-century education. Teachers Bodsworth and Goodyear (2017) had college degrees and were skilled in using learning models while teaching. However, Bodsworth and his colleague needed the training to integrate technology into their instruction. Integrating tablets into teaching is essential for teachers who use tablet technology with students with learning challenges. The purpose of Bodsworth and Goodyear (2017) was to show technology challenges in their class and manage them without having training in using tablets. At an independent day school for co-ed students, the researchers taught education to 36 students. Neither Bodsworth nor Goodyear (2017) were familiar with tablets for instruction or learning. Despite this, they introduced them to students through teacher-led education. With experience and training, teachers may be able to use tablet technology to teach and learn new things. A lack of tablet use and knowledge was a challenge in teaching students to use the tools, according to Bodsworth and Goodyear (2017). Learning expectations differed among students. Furthermore, the class was unfamiliar with tablets because of the school's technology restrictions. Teachers may only be encouraged to train in technology in schools with a technology policy, according to Rabah (2015) and Vatanartiran and Karadeniz (2015).

The most significant challenges are students' unfamiliarity with these tools and low-quality group learning, according to Bodsworth and Goodyear (2017). According to Bodsworth and Goodyear (2017), students in a social environment may be expected to develop technical skills. (2017) Bodsworth and Goodyear noted that they could not teach

students how to use tablets without a school's policy and felt no responsibility for doing so. Using these instructional tools becomes challenging when teachers lack positive perceptions of training. Tablets will be used in 21st-century education, so teachers need to be proactive and prepare themselves. Using quantitative research, Zyad (2016) investigated 56 high school teachers' perceptions of integrating these tools and the challenges they faced. Incorporating tablets to teach English as a foreign language was possible using a five-point Likert scale and semi-structured interviews. In Zyad's (2016) research, most teachers considered that training would improve their skills. According to Zyad (2016), teachers had inadequate tablet training, and their skills were based on their own experience. Zyad (2016) also suggests that teachers can train themselves when they realize the need to be technically proficient. It might be necessary to change teachers' perception of how they acquire training and become proactive in preparing their students to use technology appropriately and productively, as Dooley et al. (2016) suggested. Despite these tools' accessibility, Zyad (2016) showed that teachers had difficulty integrating them into their classrooms. Using tablets in instruction also posed personal challenges for teachers, as proven in Hsu's (2016) study.

Due to a lack of training and time, it took much work for teachers to integrate tablet use into their classes. To study how teachers perceive, incorporate, and overcome technology challenges, Hsu (2016) used mixed-method research. It was a collaboration with a teacher education program at a large university in the middle of the country that involved 152 teachers in grades 6-12. Interviews, observations, and an online survey

were used to collect data. In the study, McCrory's (2006) framework, as well as the constructivist approach to teaching, was used for integrating tablets into instruction. Teachers were unable to incorporate tablets as tools for enhancing students' interactive learning for knowledge building due to a lack of training, according to Hsu (2016).

Similarly, Dooley et al. (2016) reported that teachers without training lacked the skills to use tablets effectively. Based on Hsu (2016), teachers held a constructivist view of teaching with tablets. Teachers needed to know the social learning styles of their classes when using the constructivist approach in pedagogy. In addition to enhancing pedagogy and content, teachers committed to tablet-based learning found creative ways to use them. Using qualitative research, Dooley et al. (2016) examined how teachers in grades 6 through 12 incorporated tablets for technological pedagogical knowledge to encourage students to focus on projects. To foster creative thinking, tablets, smartphones, and video games were used. A weakness found by Dooley et al. (2016) was a lack of commitment to training for integrating these tools.

It was also noted by Rabah (2015) and Vatanartiran and Karadeniz (2015) that teachers needed to be trained to use tablets effectively. According to Rabah (2015) and Vatanartiran and Karadeniz (2015), teachers must be prepared to use tablets properly. As a result of the challenges associated with integrating tablets, teachers needed help to do group learning innovatively and collaboratively. The perception of tablet training was also influenced by teachers, according to Hsu (2016). In Dooley et al.'s (2016) study, they found that teachers were met with challenges when integrating tablets into instruction.

Online learning programs used by some teachers should have taken a more creative approach to pedagogy.

Social Media

As educators widely use social media networks, various platforms, such as Twitter, Facebook, Findparticipants.com, LinkedIn, and the Walden Participant Pool, were used to find veteran middle and high school STEM teachers as participants for this study. Twitter has proven to be a flexible, professional growth experience. Noble et al. (2016) generated quality changes in teacher practices and thoughts about teaching and learning. In their qualitative case study involving four high school teachers, Noble et al. (2016) adopted the lens of critical socio-cultural theory to explore educators' accounts of how their beliefs and values affected their participation in Twitter-based networks. They also studied how participating influenced participants' teaching practices. The authors found that teachers' values and beliefs shaped their experiences using Twitter to enhance practice.

On the other hand, Krutka et al. (2016) conducted a qualitative study involving 71 students. They analyzed survey data, reflections, and class activities from three universities to understand the successes and shortcomings of their social media experiences. The students showed several technical difficulties that could inhibit Twitter use, claiming that it failed to prepare them for class activities sufficiently. However, teachers felt that social media gave them a closer relationship with students than they usually had.

Teacher Perceptions

According to Fong et al. (2015), teacher perceptions and beliefs are a significant barrier to technology integration in the classroom. This barrier prompted a phenomenological inquiry as the authors investigated veteran high school STEM teachers' experiences. At the same time, they transformed their teaching methods from traditional twentieth-century pedagogies to facilitating twenty-first-century skills. Fong et al. (2015) met resistance to change among participating teachers that hindered efficient reform. They concluded that teachers' beliefs and expectations about their role were critical to their commitment to change.

As part of a more recent yearlong mixed methods study involving 553 teachers, Sahin et al. (2016) investigated factors contributing to comfort with tablet use. They found that the teaching experience and the number of technology tools used positively impacted teacher comfort when using tablets. However, due to a lack of technical support, some teachers' attitudes negatively followed Chromebooks during the study period.

In a quantitative descriptive study, Gurer and Curaoglu (2016) analyzed data on 507 pre-service teachers to investigate their perception of instructional technology use in teaching and learning. The authors found numerous factors that affected pre-service attitudes toward technology, including access to a computer at home and perceived technology competency. Perceived technology competency is a prerequisite for the successful completion of technology-based tasks. Gurer and Curaoglu (2016) concluded

that most prospective teachers had perceived advantages of using instructional technology in teaching and learning.

In a qualitative case study, Jones (2013) examined non-incorporating and incorporating middle school veteran teachers' perceptions of factors that encouraged or discouraged integrating technology into their learning environment. Veteran teachers who included technology were motivated by using several factors: when accessibility was high, they had received adequate training, the ease of use was high, and they saw a perceived high degree of usefulness. They perceived their age as an encouraging factor. However, the teachers who did not incorporate technology were not motivated and perceived this lack of motivation due to a lack of accessibility, little to no training, low perceptions of usefulness, and their age as a discouraging factor.

Technology Standards and Expectations

According to the International Society for Technology in Education (ISTE) Resources (personal communication, October 29, 2017), changing education requires rethinking teaching and learning. The ISTE Standards are a road map for bold, innovative educators and education leaders to redesign their schools and classrooms for digital-age learning. These standards are about tapping into technology's potential to amplify the human ability for collaboration, creativity, and communication. Whether teachers are on the road to effective educational technology integration, the ISTE Standards will help teachers create meaningful digital-aged learning experiences and innovative learning environments. Policymakers, the community, and parents pressure educators to become

qualified for and capable of technology integration into teaching (McCarthy et al., 2017). The International Society for Technology in Education (ISTE) lists seven standards and expectations for educators and students (see Appendix A and B). The standards provide a framework for students and educators to rethink education, thus leading to more creative learning environments. They aid in reengineering classrooms for digital learning (ISTE, 2015).

Role of Professional Development in Tablet Integration

Teachers' technological needs are personal, contextual, and diverse. Specifically, teachers require personalized, work-embedded continuous professional development supported by appropriate individual technical access with time to learn and contribute (McCarthy et al., 2017). In addition, teachers want to integrate technology with actual proof to improve what they are already doing and incorporate it easily. These beliefs and values do not typically differ in teaching experience between novice and veteran teachers (Kimmons & Hall, 2016).

Challenges Veteran STEM Teachers Face Using Tablets in the Classroom

Barriers or challenges in the classroom that affect successful technology integration have affected veteran STEM teachers. However, countless factors, such as a teacher's confidence, training, time, and support, affect their purpose for change. In a case study, Tallvid (2017) explored teachers' reluctance toward the pedagogical use of personal laptops in secondary schools. Teachers' reluctance to use technology revealed a

lack of technical competence, not worth the effort, defective material, diminishing control, and lack of time.

Like Tallvid (2016), Hsu (2016) interviewed eight teachers in a mixed-methods study to examine their existing beliefs, practices, and barriers to technology integration in Kindergarten through Grade 6 classrooms. The findings showed that most teachers held constructivist pedagogical views about technology integration and four barriers: students' lack of computer skills, teachers' absence of training in technology, teachers' lack of time to implement technology-integrated lessons, and teachers' lack of technical support. This statement answered research question two of this study about teachers' experience integrating tablets into the classroom.

Teachers also faced the challenge of effectively engaging in student conversation during a bullying-related incident (Schussler et al., 2017). In an exploratory study, Schussler et al. studied 27 undergraduate teacher candidates and examined the effectiveness of "virtual role-play" (VRP). VPR is a tool developed to aid teachers in effectively responding to bullying. They hypothesized that simulated conversations provided by the VPR tool would improve teacher communication skills by enhancing fluency when responding to classroom bullying. Teachers could use better word choices, reducing their reliance on notes. The findings showed that teachers might only prepare for some encounters. Therefore, the more they practice and include students, the more effective they will be when faced with bullying.

TPACK Model as a Professional Development Tool

Harris (2016) recommends that teachers begin with general technological knowledge, analyze and apply technologies in educational environments, and then use that technical and pedagogical knowledge to teach specific content using digital tools and resources. In addition, TPACK approaches inspire teachers to work collaboratively on practice problems with colleagues. There are 12 process-based methods (Appendix C) of TPACK-related professional learning.

In-service teacher Technological Pedagogical Content Knowledge (TPACK) is built upon interactions between subject matter knowledge, pedagogical strategies, technologies, and the contexts they transform using technology. In-service teachers require training, constant and usable professional development (PD), and support beyond technology-related approaches disconnected from practice. In-service teacher TPACK represents how technology transforms students' learning, content representations, specific teaching methods, and classroom management (Baran et al., 2016). The TPACK-based PD program aims to increase teachers' awareness of domain-specific technologies used for learning and teaching, develop their knowledge about integrating technology into classrooms, and increase their self-efficacy toward designing technology-enhanced classrooms (Baran et al., 2016).

Professional Learning Needs

One of the aims of this study was to find veteran middle and high school STEM teachers' learning needs to integrate tablets into the classroom effectively. Teachers need

the certainty of having proper bandwidth to support their devices (Kimmons & Hall, 2016). The teachers' technology is diverse, personal, and contextual. Teachers need personalized, work-embedded continuous professional development supported by proper individual technology access with time to learn and share. Professional development will enhance teacher confidence and skills when integrating technology into the classroom (McCarthy et al., 2017). STEM teachers want to incorporate technology that will integrate with ease and enhance what they are already doing. These beliefs and values do not differ in teaching experience between novice and veteran teachers.

The invention of recent technologies and their abilities to enhance teaching and learning have changed classroom teaching methods. Innovative technologies have affected how teachers use these technologies to help students learn (Thompson, 2015). Technologies are integrated based on the context and the needs of the students and the teachers. According to Christensen and Knezek (2017a), teachers should feel comfortable using modern technologies and must also add pedagogical strategies for efficiently integrating technology into learning. According to Fong et al. (2015), there is a definite need for professional development that responds to essential pedagogical reform for teaching twenty-first-century skills. The condition was shown for veteran teachers because they come from a generation that has never immersed themselves in digital tools.

According to Project Tomorrow (2016), 84 percent of school principals acknowledge the critical need for effective classroom integration. They also recognized the barrier as a lack of professional development, including integrating digital technology

content into instruction. In a qualitative case study, Christensen and Knezek (2017) invited grades K–12 to send data related to their mobile readiness.

Benefits of Teaching with Tablets

There are several benefits to the use of tablets in the classroom. Winstead (2017) described some of the help:

> Easier to use than desktop and laptop computers, or even paper books, more intuitive, allows direct communication with the student, parents, and the teacher, and provides a live knowledge base giving the teacher the ability to engage with students in real-time a click. Tablets had a personal approach allowing teachers to address multiple learning styles. They adjust for slow learners, and adaptive people with disabilities will appreciate the flexibility, freedom of access, and tailored curriculums. Tablets are more cost-effective than textbooks; they offer full scalability, are lightweight, and fit thousands of texts in a single device. They provide quicker reporting, allowing students to document events and instances immediately, improving computer skills, and boosting creativity. A student can draw, compose music, or make films with no extra tools needed on the tablet. They offer teachers hassle-free assessment, gain easier classroom management while finding various teaching strategies, and reinvent the curriculum; homework is paperless, and paperless innovation is the new buzzword. Learning simulations are also available on tablet devices. (pp. 2–5)

This information supported research question two since it showed teachers' opportunities and benefits when integrating tablets into the classroom. Tablets incorporate laptops and handheld devices and are easy to use to combine content production and learning. When using tablets in K–12 classrooms, research showed increased student motivation, engagement, collaboration, and productivity. Students collaboratively created and shared apps with tablets, leading to a significant difference between tablets and other hand-held devices (Jahnke & Kumar, 2014).

Tablet Integration

STEM teachers are the most crucial facet of integrating tablets into the classroom. Tablet devices captured students' interest while the teacher created the perfect environment for unique collaboration and interaction with the content. With tablets, the veteran teacher watched learning in real-time. Frey et al. (2013) presented a four-phase framework for teaching. The framework is helpful across all content and grade levels. For effective teaching results in the classroom, the teacher should show the characteristics of the four-phase framework, which are to present:

- Focused instruction – Present the lesson's purpose to alert the students to a learning target and provide them with goals to measure their progress—present modeling of thinking aloud, giving the learner insight into how experts understand the content process,

- Guided instruction – is when students begin to apply skills and strategies the teacher introduced. Allowing the teacher to watch progress and collect formative assessment data,
- Collaborative learning – This allows the students to engage in face-to-face and digital conversations on topics that deepen the understanding of the skill, strategy, or topic,
- Independent learning – This is the time when students apply the skills they are taught. (pp. 7–8)

Positive Views

While rallying interest over the past few years as the best digital learning device in school, tablet technology has progressed. Older students with more skills than teachers can aid with tablet devices. Due to their childhood experiences going beyond playing games and watching a video, they are coming to class technically savvy (Jordan et al., 2016), allowing students the opportunity to aid veteran teachers with tablet integration into the classroom. According to Jahnke and Kumar (2014), tablets integrate the same features as laptops and handheld devices. Tablets are easy to use and run several applications helping content production and learning.

Efficiently integrated technology leads to positive learning outcomes (Smirnova & Bordonaro, 2014). Efficiency and impact are more prevalent when using tablets in the classroom. More schools are choosing tablets rather than computers or textbooks. They connect vital stakeholders such as students, teachers, and parents through direct

communication. Engaging material can be delivered in real-time, creating a live knowledge base. STEM teachers can use a personal approach to address many learning styles, including slow or faster learners.

Tablets allow the ability to access millions of textbooks on one device. They simultaneously document explorations such as field trips, leading to quicker reporting. The use of tablets also improves computer keyboard skills. The choice of paperless homework exists. Tablets offer the opportunity to teach using simulations. Students will learn what professionals, such as soldiers, surgeons, pilots, and truck drivers' experience. The National Education Technology Plan (NETP) (2017) lists five ways that technology can improve and enhance learning in both formal and informal settings:

- Technology can enable personalized learning or experiences that are more engaging and relevant.
- Technology can help organize real-world challenges and project-based learning using various digital devices and resources to show competency with complex concepts and content.
- Technology can help students move beyond the classroom and take advantage of learning opportunities available in museums, libraries, and other out-of-school settings.
- Technology can help learners pursue passions and personal interests.
- Technology access, when equitable, can help close the digital divide and make transformative learning opportunities available to all learners. (pp. 12–17)

Opposing Views

The use of tablets can often lead some students to be distracted. With a device that can take them virtually anywhere, students tend to wander about other sites if not watched closely, while using several windows and files may become a challenge. Teachers have reported having difficulties managing the tablets and finding applications to use in the classroom (Jahnke & Kumar, 2014). Students are also distracted by the many features that tablets offer.

Summary and Conclusions

Chapter 2 presented four significant areas of a literature review from which I identified themes for examining data and answering the research questions. These included: Benefits of Tablet Use in the Classroom, Integrating Tablets into Instruction, Challenges, and Risks in Integrating Tablets, and social media. Using tablets in teaching and best practices could improve social and academic learning. Nonetheless, there are challenges to integrating these tools, which may be personal or environmental. I included the TPACK framework in my literature review to understand technology integration better. There was a clear connection between TPACK and tablet use in instruction, as shown by the literature review. According to the literature review, tablets could be comprehensively applied to teaching. According to the literature review, there is a need for further research on using tablets as tools to improve pedagogy and content. Classroom teachers also need to understand how to incorporate tablets into instruction creatively, and they should explore more technology devices used and the challenges and benefits of

digital tools (Hillmayr et al., 2020). Integrating tablets could facilitate students' participation and address their learning challenges (Chin et al., 2019). A study of eight middle and high school veteran STEM teachers explored how these tools enhanced pedagogy and content, revealing the knowledge needed for tablet training, professional development, and teaching (Karlsudd, 2018).

The present study filled a gap in the literature since the impact of technology integration in the classroom has been studied comprehensively. Still, less has been shown about teacher perceptions of its use in the school (Domingo & Gargante, 2016). This study about veteran STEM teacher perceptions expanded the knowledge in this discipline. The research design, sample selection, data collection instrument, and data collection procedure are discussed in Chapter 3, along with the methodology. Data collection and analysis for this study are discussed in chapter 4. Chapter 4 also covers the data collection processes, including instruments, coding, methods, compiling the data, and analyzing it. It also discusses the results' significance, validity, and trustworthiness and summarizes Chapter 5. The findings of Chapter 5 are summarized, limitations are defined, recommendations are given, implications are outlined, and conclusions are presented.

Chapter 3: Research Method

This qualitative study aimed to show teachers' perceptions, knowledge, and strategies for using tablets to differentiate instruction among veteran middle and high school STEM teachers. The problem investigated in this study was that some middle and high school veteran STEM teachers are reluctant to integrate tools such as tablets into their curriculum. Further, this study investigated how tablets could reinforce student learning experiences in communication areas. Using tablets in the classroom could ease integration challenges and facilitate student learning modalities (Chin et al., 2019). Technology integration has been studied extensively for its impact on learning; however, little information about veteran teachers' perceptions of mobile technology and its implications on education and classroom relationships exists (Domingo & Gargante, 2016).

Chapter 3 describes the research design and rationale for the chosen research methodology. The role of the researcher, as it relates to the data collection and analysis procedures, is also explained. The Methodology section outlines the chosen participant selection strategy and data collection methods, including a semi-structured telephone interview, a Zoom audio-recorded interview, and teachers' technology-infused lesson plans. Chapter 3 also discusses the data analysis methods, trustworthiness, ethical methods, and protection of participants before closing the chapter with a summary.

Research Design and Rationale

Qualitative research focuses more on processes than outcomes; it is aimed at understanding how people acclimate and adjust to their life experiences (Creswell & Creswell, 2017). This study was conducted to determine if tablets could effectively support learning in STEM classrooms using a qualitative approach (see Merriam & Tisdell, 2016). In the present study, the research questions aimed to ensure that the veteran teacher participants freely divulged the challenges and opportunities met when integrating tablets into STEM classrooms:

RQ 1: How do middle school and veteran high school STEM teachers perceive the process of integrating tablets into the classroom?

RQ 2: What challenges do veteran middle school and high school STEM teachers observe when integrating tablets into the classroom?

RQ 3: What opportunities do veteran middle school and high school STEM teachers observe when integrating tablets into the classroom?

Exploring teachers' perceptions could not be accomplished using a quantitative design but by adopting the qualitative case study design outlined by Yin (2014). Researchers can gather opinions, frames of mind, or thoughts about things. using a quantitative survey method that has proven legitimate and reliable. But qualitative research focuses on broader open-ended questions. In contrast to quantitative research, qualitative research seeks to understand the societal reality of an individual or group close to how the participants lived or experienced the sensation (Denzin & Lincoln,

1994). Qualitative research is intrinsically contextual, objectively explains, and contributes to the development of common knowledge (Merriam & Tisdell, 2016). Researchers should conduct basic qualitative research whenever they want to understand the challenges of everyday life from the participant's perspective (Percy et al., 2015). Qualitative studies are ideal when a comprehensive, top-to-bottom investigation is needed (Feagin et al., 1991).

A case study design was proper since I examined experiences in depth in a real-world context (Yin, 2014). Qualitative instruments for data collection included semi-structured telephone interviews, Zoom audio-recorded interviews, and teachers' technology-infused lesson plan paradigms. Other traditions included basic qualitative research, ethnography, grounded theory, and heuristic inquiry. When conducting an introductory qualitative research study, the researcher's focus should not solely be on participants' beliefs, attitudes, or ideas about the phenomenon of interest. Instead, the emphasis is on how individuals interpret their life experiences, construct their worlds, and their meaning to those experiences. Consequently, basic research would require a broader study than the current investigation envisages.

On the other hand, ethnographic inquiry studies evolve when humans interact with one another for some time (Patton, 2015). As cultural behavior was not the focus of this study, and its aim was not to interpret the culture of veteran teachers, this research approach would not be suitable. In grounded theory research, the aim is to generate a new theory based on the findings yielded analysis to explain what was seen (Patton, 2015). As

the purpose of this study was not to create a theory, this research method was not suitable again.

Researchers conducting heuristic inquiry studies are primarily interested in the participants' experience of others whose views of the phenomenon can inform the investigation (Patton, 2015). The heuristic approach may bias and threaten the validity issues that must be expertly countered and alleviated. As the present study aimed to understand the perceptions of veteran middle school and high school STEM teachers who were integrating tablets into the classroom, seeking input from others would make it challenging to control biases. The distinction between this study and other studies delineating technology integration at the school was that the present investigation focused on veteran middle and high school STEM teacher perceptions while integrating tablets into the classroom. Some of the teachers who participated in this study may have had the training to integrate tablets into the classroom.

Role of the Researcher

The researcher is the data collection and interpretation instrument (Patton, 2015). In this role, I gathered, interpreted, and analyzed the required data for meeting the research objectives obtained through a semi-structured Zoom audio-recorded interview and a review of teachers' technology-infused lesson plans. While interviewing the study participants, I practiced empathic neutrality to understand the interviewees' situations and perspectives without being judgmental. I communicated to participants that understanding authenticity helped me build rapport with the interviewees, eliciting their

trust and openness (Patton, 2015). I managed to avoid bias by reporting all information provided by participants with fidelity and prompted the interviewees to share their views without steering the conversation in any direction (Yin, 2016).

It is also important to note that I had no personal relationships with the study participants. However, I have been an educator for 12 years and have taught grades K–12. Moreover, as a technology coordinator and computer specialist, staff, professors, and district teachers integrate technology into the curriculum while implementing research recognized as the Preparing Tomorrow's Teachers to Teach with Technology (PT3) Grant. In this role, I was responsible for the technology department staff while providing executives feedback for evaluation purposes. My daily responsibilities included diagnosing, repairing, supporting, upgrading, and securing 72 computers and servers during my employment. My extensive knowledge in this role was pertinent to the present study and assisted me in bringing a keen sense of ethics to my research (see Yin, 2016). Specifically, while working on PT3 implementation, I learned the importance of adhering to ethical standards such as confidentiality. Hence, I know the need to assure research participants that their information would be used solely for research purposes and accessible only to those directly involved. Similarly, I assigned pseudonyms in any reports or publications from this study to protect participants' privacy.

Controlling Researcher's Bias

Several factors can prevent candidates from sharing personal experiences Maxwell, (2013). In my previous teaching experience, I learned how to integrate tablets

with instruction. I managed my biases and kept a diary by maintaining a neutral approach during data collection. Data collection was conducted objectively and neutrally (Miles et al., 2014) in addition to occupying a passive role (Curry et l., 2009). As part of the interview protocol, I reviewed the questions in advance and avoided giving candidates choice words or hypothetical examples. It was vital for me to control my tone, so I did not indicate to candidates how I expected them to answer.

Methodology

The population consisted of eight veteran middle and high school STEM teachers using tablets for integration in the classroom. The sampling strategy was selected fitting the purpose of this study, resources available, research questions, and constraints (Patterson, 2015). To meet the criteria for the study, participants had to use tablet technology when creating their lesson plans. Based on these criteria, convenience sampling was chosen for this study. For convenience sampling, participants were selected based on ease of availability (Patterson, 2015). In this study, technology teachers who integrate tablets into middle and high school instruction participated.

Internet recruitment and a social media invitation flyer were used for recruitment. Those who responded to my invitation did so by email (I supplied my email address on the flyer). As soon as a volunteer responded, I emailed the informed consent form with the inclusion criteria for them to complete and return.

Participant Selection Logic

Eight participants were chosen for this qualitative case study. The original intent was to recruit 10 teachers from district schools. Due to the COVID pandemic, teachers had to be selected via the Internet. The invitation flyer noted that the target audience was veteran middle and high school technology teachers who used tablets in the classroom. When volunteers responded to my invitation to participate, I emailed them the informed consent form with the inclusion criteria, which they had to read, complete, and return. Once the informed consent was returned, I verified signatures, contact information, and details about their use of tablets in the classroom.

This research aim was to elucidate veteran middle and high school STEM teachers' perceptions of integrating tablets into classroom instruction. The main strength of the case study stemmed from its capability to accommodate a range of evidence types, including data from interviews (Yin, 2014). The population of interest for this investigation included veteran middle and high school STEM teachers via social networks. I recruited eight veteran STEM teachers for the study. Saturation should be the guiding principle for data competence (Hennink et al., 2019); saturation in qualitative research shows that no further data collection or analysis is necessary (Saunders et al., 2018). Eight participants were enough to achieve data saturation in this study.

Instrumentation

In a case study, documentation, interviews, direct observation, participant observation, archival records, and physical artifacts can be data sources (Yin, 2014). This

study used a 30-minute individual Zoom semi-structured telephone interview, a 30-minute Zoom audio-recorded online interview, and teachers' technology-infused lesson plans, which all participants provided. Each data source is listed separately here. First is a discussion of the lesson plan evaluation form. It serves two purposes. The first purpose is to find which individuals used tablets appropriately for this study. The second was to figure out which interview probes to use and the primary investigations used with everyone based on the activities they have included in their lessons. I asked each participant core interview questions and additional questions based on the participants' tablet usage characteristics. Thus, the interview questions are palette-based material in the lesson plans.

Similarly, the interviews followed an interview protocol, including questions and prompts related to the research purpose. The discussions to gain in-depth information from the participants worked out well. The guide was a checklist ensuring all pertinent topics were conveyed (Patton, 2015). These instruments yielded vital information about the participants' perceptions of using tablets in the classroom. These three sources aided in answering the research questions. Creating a matrix to collect evidence from these documents, I designed semi-structured interview questions, data gathering tool for lesson plans, and interview protocol. The interview questions aimed to prompt participants to share their views rather than supply yes or no responses. Thus, I followed Yin's (2016) semi-structured interview style as a researcher, which allowed me to develop a more personal relationship with the participants. Specifically, as Yin advised, I engaged each

interviewee in a conversation by asking open-ended questions. Similarly, the tool allowed me to see how and to what extent teachers used tablets in their classrooms. Finally, I used the information yielded by the audio-recorded interviews to corroborate the findings (Yin, 2014).

Teacher One-to-One Zoom Telephone Interview Questions

Research Question 1: How do veteran middle and high school STEM teachers perceive the process of integrating tablets into the classroom?

Teacher Interview Questions

1. How have you integrated tablets into your lesson plans?
2. How do you perceive the process of integrating tablets into the classroom?

Research Question 2: What challenges do veteran middle and high school STEM teachers experience when integrating tablets into the classroom?

Teacher Interview Questions

1. How often do you use tablet technology in the classroom?
2. What are some of the challenges experienced by you when integrating tablets into the classroom?

Research Question 3: What opportunities do veteran middle and high school STEM teachers observe when integrating tablets into the classroom?

Teacher Interview Questions

1. What opportunities have you seen developed from tablets in the classroom?

2. How much do you collaborate with other teachers to integrate tablets? Please supply an example.

Zoom Audio Interview Questions

Research Question 1: How do veteran middle and high school STEM teachers perceive the process of integrating tablets into the classroom?

Teacher Interview Questions

1. How much do you believe all students can benefit from STEM instruction?
2. What strategies do you use to incorporate tablets into the classroom?

Research Question 2: What challenges do veteran middle and high school STEM teachers observe when integrating tablets into the classroom?

Teacher Interview Questions

1. What barriers do you feel are most difficult to contend with during integrating tablets into the classroom?
2. What strategies do you use to overcome these barriers?

Research Question 3: What opportunities do veteran middle and high school STEM teachers observe when integrating tablets into the classroom?

Teacher Interview Questions

1. How has integrating tablets in the classroom enhanced your teaching practices?

2 How often do you collaborate with other teachers to gain new knowledge about integrating tablets into the classroom?

One analytic strategy used in this study is a matrix (see Appendix I). The matrix consists of four categories: research questions, one-to-one semi-structured telephone interviews, Zoom audio-recorded semi-structured interviews, and teachers' technology-infused lesson plans. Thus, data taken from each type supplied evidence to answer the research questions. As I was looking to supply proof of STEM teachers' perceptions of integrating technology into the classroom, the barriers involved, and opportunities observed while integrating tablets.

Procedures for Recruitment, Participation, and Data Collection

Since I work at a local school in Alabama, I first emailed and called the district administrator. I communicated with the school district administrator to find out if teachers from his schools would be allowed to participate in my research study. As a result, the administrator allowed me to begin the investigation. In response to my request, two principals sent me a list of names they wanted me to contact for participation. As part of my research study, I began finding potential participants. The first target population was ten high schools STEM teachers who used tablets in the classroom. To encourage and engage participants in the study, I offered a $50.00 Amazon or Starbucks gift card (their choice). Most of the teachers on each list were not eligible since they mostly used laptops in their classrooms. COVID then struck, and some became ill. Internet communication was the only way for the three remaining to communicate.

Having discussed this issue with my Chair, I was advised to turn to social media and seek five more participants, requiring IRB approval again. With members of my

dissertation committee's aid, I developed a questionnaire as soon as I received Walden's IRB approval (07-29-19-0109444). The questionnaire is attached as Appendix J. Participants were assessed using a questionnaire. However, only a few participants qualified. Potential participants who did not qualify were informed of why and thanked for their participation. Collaborating with a dissertation committee member, I designed invitation flyers to recruit volunteers. The invitations were posted to various social media websites such as LinkedIn, Facebook, and Twitter, and I also used the Walden Participant Pool, Instagram, and FindParticipants.com. The snowball sampling method was then used. In research focusing on specific research phenomena, the snowball sampling strategy is commonly used to show a chain of "people who know people who know people" (Patton, 2015, p. 270) who have knowledge and experience relevant to the research topic.

As soon as I found potential candidates, I began collecting data. Eight participants were selected, which was the required number. Participants accepted my invitation, and I replied to them by email. Participants who met the requirements were scheduled for virtual interviews at a specific time and date. Approximately one month was spent collecting data. A Zoom audio recording was conducted, a Zoom telephone conference call followed, and a copy of the teacher's technology-infused lesson plans was reviewed. Each participant was interviewed in depth twice. The Zoom audio-recorded interview and Zoom telephone conference call lasted 30 minutes; each event lasted 60 minutes. As part of the follow-up procedure, I arranged to send the participants copies of the transcripts of

their interviews so they could verify the accuracy of what they said. For their cooperation, I thanked them in my closing statement.

Data Analysis Plan

To develop an in-depth understanding of veteran middle and high school STEM teachers' perceptions of integrating tablets into the classroom, I asked each participating teacher to supply a copy of their technology-infused lesson plan to provide an in-depth understanding. (See Appendix G for Participant Invitation). A detailed review of each lesson plan allowed me to learn which teachers were integrating tablets into the classroom and to what extent. The information obtained from these lesson plans also prepared me for the Zoom telephone and audio-recorded semi-structured interviews. I asked the participants what challenges, opportunities, and perceptions they observed when integrating tablets into the classroom.

I used Computer-Assisted Qualitative Data Analysis Software (CAQDAS) to analyze the data gathered for this study. In addition, I relied on the NVivo software package as a guidance tool. According to Yin (2014), software tools are helpful when coding and categorizing chunks of data. I entered textual data and defined the initial sets of codes. The software found the matching words and phrases in the data and counted the occurrences of all predefined codes to identify any patterns that emerged from this process. Subsequently, I reviewed them to ensure that the chunks of information did not just use the same word but also meant the same thing. If they did not, I created a new code. Although it gave me various occurrences, I did not use that information because it

may not tell me much about the data shared. I studied the outputs as recommended by Yin (2014). Developing these codes further into the main themes, the research questions in this study became obvious. All interviews were audio-recorded and transcribed before using NVivo software to organize the data and find patterns and articles I might have overlooked using manual analysis.

Issues of Trustworthiness

Credible, transferable, dependable, and confirmable characteristics should be present in qualitative research. The process of achieving trustworthiness can take several forms. These methods include triangulation, audit trials, peer debriefing, and prolonged engagement (Ravitch & Carl, 2016). My study was a triangulation of data collected from questionnaires, interviews, and lesson plans infused with technology. During the study, I also conducted member checks with participants. I supplied reliable means of investigating the problem by ensuring trustworthiness in this qualitative case study. Finding and understanding the gap, naming candidates, selecting samples, designing instruments, and collecting and analyzing data are ways to manage the research. As discussed below, there are four qualities of trustworthiness: credibility, transferability, dependability, and confirmability. In the following sections, I addressed the study's credibility, transferability, reliability, and confirmability. After discussing the ethical procedures relating to the treatment of human participants, I summarized all the elements needed for qualitative research related to perceptions of veteran middle and high school STEM teachers' perceptions of integrating tablets into classroom instruction.

To meet the study goals, I collected data from the participating teachers via individual Zoom telephone audio-video online interviews and reviewed each teacher's technology-infused lesson plan. While proving credibility, I triangulated several sources of Information as Yin (2014) recommends. In a research investigation, trustworthiness refers to the confidence level in information, explanations, and methods used to ensure the study's validity (Polit & Beck, 2014). In King, Horrocks, and Brooks (2018), reliability and validity are crucial to the trustworthiness of qualitative research studies. Researchers can evaluate qualitative research quality by evaluating its credibility, dependability, transferability, and confirmability. Testing qualitative research's trustworthiness increases credibility and dependability (King et al., 2018). For this study, I provided the participants with procedures and protocols of interest (Amankwaa, 2016).

Credibility

Credibility is the basis of trustworthiness in qualitative research. Credibility refers to confidence in a study's truthfulness and findings. Credibility is one of the essential criteria in qualitative research (Polit & Beck, 2014). The credibility of an argument can be evaluated using the truth or validity of that argument (Hammarberg, Kirkman, & de Lacey, 2016). Credibility was proven through triangulation. In triangulation, multiple sources of data are obtained and analyzed (Ravitch & Carl, 2016). The questionnaire data, notes from interviews, and teacher lesson plans helped triangulate the results and supply detailed descriptions. Credibility was also enhanced by performing member checks. A member check aims to allow participants to check the researcher's findings and

interpretations and confirm that the conclusions are accurate (Creswell & Poth, 2017). I conducted my member checks by providing participants with the results of my study and asking them if they were correct in describing their thoughts and experiences.

Credibility in qualitative research was also proven when participants believed in their findings and interpretations. The researcher allowed participants to review the transcripts of their interviews and make any alterations they considered necessary. After receiving participant feedback, I corrected or adjusted the presentation in areas of necessity to show credibility. In qualitative studies, credibility is determined by how well context and results are presented and whether those taking part in the study can recognize the results (Merriam & Tisdell, 2016; Mertler, 2016).

Transferability

A study's transferability is measured by its ability to help individuals in different settings (Polit & Beck, 2014). The readers will interpret the study's findings, considering their circumstances (Polit & Beck, 2014). By using thick descriptions, future researchers can figure out how and where this study can be applied (Merriam & Tisdell, 2016). I reinforced and used thick descriptions throughout the study to maximize transferability, using a realistic, positive portrayal of the context, participants, and areas discussed, and being clear about the study's purpose and results (Amankwaa, 2016).

Dependability

The researcher ensured dependability by documenting analytical and traceable research procedures (Patton, 2015). According to Cannon (2017), trustworthiness

involves determining whether the researchers' approach is consistent and dependable among other researchers (p.69). I documented the research procedure to ensure consistency and repeatability (Shenton, 2004). I used cross-comparisons to offer insights into emergent categories of themes from the interview data. Dependability, also known as reliability, refers to the ability of other researchers to employ the same case study method and achieve equivalent results. To make the data collection process repeatable, I ensured it was dependable and consistent, as advised by Shenton (2004). I conducted interviews with open-ended questions to collect comprehensive data and examples for integrating tablets into instruction. Each participant was asked the same questions. In addition, I saw how candidates incorporated tablets into pedagogy and content to enhance the learning experience. Research audits and critiques should be possible based on documented procedures.

Confirmability

In research studies, confirmability is ensured by "establishing that the data and interpretations of an inquiry are not merely figments of the researchers' imagination" (Patton, 2015, p. 685). In other words, confirmability is how different individuals can confirm the research findings of a qualitative study (Miles & Saldana, 2014). Participants were informed of the purpose of the research study, and I ensured that data were collected that reflected realistic approaches to integrating tablets into instruction. My diary of opinions and experiences helped me manage this investigation and avoid researcher bias (Patton, 2015; Shenton, 2004). My preference for this study remained neutral throughout

the study to ensure objective results, as recommended by (Miles et al., 2014). Throughout this study, I applied and used consistent methods.

Ethical Procedures

I attached the Interview Protocol (Appendix A) for ethical procedures as part of Walden's IRB approval. Candidates had to answer all questions on the interview protocol. The Interview Guide was included (Appendix B). I also included The Participant Invitation (Appendix C). The Informed Consent Form was also included (Appendix D). Volunteers for data collection interviews were asked to sign an informed consent form that addressed their ethical concerns. I assured candidates that the data collected would benefit and expand their understanding of integrating tablets into the classroom. Candidates were informed of the risks and benefits of this study and their right to withdraw if desired. If a candidate needed to withdraw, no coercion was involved. All participants in this study were informed that their information would remain confidential. According to Patton (2015), researchers should use a humanistic approach based on equity, fairness, and mutual respect. Additionally, I ensured that the IRB Forms A and C did not have any ethically significant issues. The Walden University approval number was 11-20-20-0196670.

Participant recruitment took place online. I did not influence the candidates to supply partial data in this research study. During the interview process, I stored interview data on paper and a thumb drive that was only accessible to me. The interview data on the thumb drive will be destroyed, and the documents will be shredded after five years. There

were no data collection activities at my workplace, and I had no control over any of the potential candidates.

Summary

Chapter 3 began with an overview of the study purpose described in Chapter 1. In the research design and rationale, I restated the research questions and defined the central concepts and phenomena of the study. Furthermore, I found the research tradition and explained why this tradition was chosen. As a researcher, I defined and explained my role. I showed that I had no personal or professional relationship with the participants during the interview. Moreover, I discussed that no supervisory or instructor relationships involved power over participants. As part of my discussion, I named ways researcher biases and power issues were managed and strategies to resolve them. A method for collecting data was shown, the population was identified, the sampling strategy was justified, and the criteria for selecting participants were outlined. Also, I explained how participants met the requirements and how the number of participants was decided. The recruitment process was explained, including how participants were selected, contacted, and recruited. The relationship between saturation and sample size was also discussed. Chapter 4 overviewed the chapter's purpose, research questions, and organization. The setting, demographics, data collection, and analysis were briefly described. In conclusion, evidence of trustworthiness, the results, and the chapter's summary were discussed.

Chapter 4: Results

This qualitative case study aimed to explore veteran middle and high school STEM teachers' perceptions of integrating and using tablets in the classroom. The research sources were semi-structured telephone interviews, Zoom audio recordings, and technology-infused lesson plans from teachers. Triangulation was conducted using multiple data sources as a system of checks and balances. The research questions related to perceptions of integrating tablets, challenges with integration, and opportunities through integrating tablets were answered through these sources.

This chapter includes the information of analysis of data collected using NVivo. Chapter 4 describes the introduction, setting, demographics, data collection, data analysis, discrepant cases, evidence of trustworthiness, results, and summary. I also address proof of reliability through credibility, transferability, dependability, and confirmability.

Setting

The qualitative case study used Zoom audio and a semi-structured Zoom interview. The participants were from the United States and the United Arab Emirates (UAE). The teachers interviewed in this study teach at various schools. In the United States, education is free and compulsory for 10 years, beginning at age 6 and culminating at age 16. According to the Embassy of the United Arab Emirates Cultural Division in Washington, D.C. (2003), the education system of the UAE was set up in the early 1970s. Primary and secondary education is provided for all UAE citizens (UAE, 2013). Public

schools in the United Arab Emirates are government-funded, and the curriculum matches their goals and values. Instruction in public schools is Arabic and English as a second language. Education at primary and secondary levels is universal and compulsory up to the ninth grade and takes place in a 4-year process for over 14 years (UAE, 2013).

Demographics

For this study, I interviewed a total of eight participants. Participants were all veteran teachers who had taught for at least 5 years and used tablets in the classroom. Four participants from the United States and four from the UAE agreed to participate in the study. There were three males from the United Arab Emirates. Two taught Grades 12, and one taught Grade 10. This study involved five female participants, one from UAE and four United States. A female participant from the UAE taught Grade 12. Of the four Americans, one taught Grade 12, two taught Grade 8, and one taught Grade 10 (see Table 1).

Table 1

Research Participant Demographics

Participant	Gender	The U.S.	U.A.E.	Grade Taught	Courses	#Yrs Teaching
P1	Female	x		12	Environmental Science, Chemistry, Physics	6
P2	Male		x	12	STEM, Robotics, Coding	5
P3	Male		x	10	Math	15
P4	Female		x	12	Physics, Math	5
P5	Male		x	12	Biology, Science, Math	7
P6	Female	x		8	Math	9
P7	Female	x		8	Math	10

P8	Female	x	10	Science	11

Participant 1 is a female 12th-grade environmental science, chemistry, and physics teacher from the United States with 6 years of teaching experience. She integrates tablets into the classroom in many ways. Her favorite method of integrating tablets is using forms with students. The integration process is simple for her since the school provides each grade level with two to three carts of tablets. Her students are more confident with technology in other school areas after using it in the classroom. They can share ideas and thoughts without too much distraction. Exposure to the outside world is increasing through news articles and research.

Participant 2 is a male teacher from the UAE who has taught 12th grade for 5 years and teaches STEM classes, including robotics and coding. Students are trained at home by watching the National Geographic Channel; most learn from games and movies. The students are taught about the earth using the tablet, on which they watch a daily video about the lesson. Students listen, read, and then go outside. The best way is to have virtual labs where every student participates in experiments at home. For example, students can send their answers as a document during lab tests. Students are now more technologically savvy; they know much more about computers than teachers.

Participant 3 from the UAE teaches 10th-grade math and uses tablets daily with the whole or small group technology stations for math and science lessons. He has been teaching 10th-grade math for 15 years. Tablets allow students to be discreet in their classrooms. Coming from the UAE, a third-world country, students' exposure to

technology is limited. Tablets are perfect for a couple of higher-level students, as they can do research and extra math. Therefore, students learn that tablets are a valuable extension of the learning process. Most students already use tablets at home and know how helpful technology is in their everyday lives. This teacher noted the challenges of finding safe, friendly, and pertinent websites for 10th graders. Tablets are helpful as they allow students to collaborate and aid each other. His students are not afraid to explore what they can find or learn and often teach him new things about the tablet. Strategies he uses to incorporate tablets rely on various websites for science and math. Students like these sites because they are research-based and safe.

Participant 4 from the UAE is a 12th-grade math and physics teacher who feels valuable opportunities arise when students work diligently on performance-paced websites using tablets. She helps this process by using the data to supply meaningful whole- and small-group lessons. She feels veteran teachers encourage technology integration into the classroom because it motivates students by linking lesson content to real-life issues. Tablets also help teachers drive instruction by supplying prompt information on student achievement. She integrates tablets into her lesson plans by assigning students to a digital center. As students rotate, they effectively use tablets to reinforce what the teacher has already taught in the classroom. She perceives integrating tablets into the school as necessary, especially in the 21st century, where everything depends on technology. She further said that her only challenge thus far was lagging

Internet speed during district-wide assessments. She finds tablets particularly valuable as a tool for enhancing student performance.

Participant 5 is a male teacher from the UAE who teaches 12th-grade science, biology, and math and uses tablets daily in the classroom. He finds that integrating tablets into the school is easy for students who enjoy using them. He tries to use them as much as possible since living in the age of technology. He notes that several opportunities have developed because of tablets, as they are easy to use, making them very appealing for projects. He also feels that all students can receive help from STEM instruction since they can cooperate and transform ideas into real-life engineering projects. He thinks inadequate availability is the most significant barrier to integrating tablets into the classroom. In his classes, he addresses this issue by having students work in pairs or rotate so everyone can have an opportunity to use the tablets.

Participant 6 is a female teacher from the United States who has taught eighth-grade math for 9 years. She uses tablets to stimulate student learning. Her students use tablets to research science topics and produce presentations, reports, and videos that show the knowledge they have gained. She finds iPads beneficial to learning as students can collaborate with others and access online resources, such as videos that enhance their understanding of the topics they are studying. However, she also notes that many students need instruction and support in the proper and effective use of tablets, but they are very receptive, motivated, and willing to help their peers once they learn a new skill. In her classroom, tablets are used at least two or three times per week based on a schedule that

allows all students about 30 minutes to access online learning programs. However, this teacher also finds tablets challenging with technical issues, especially since a full-time technology assistant has not been in her building for a year. When such problems occur, students get distracted and require discipline. This is addressed by clearly saying the expectations of the project, showing students the time they have left to complete the project, and closely watching students while they work.

Participant 7, a female teacher from the United States, taught eighth-grade math for 10 years. She perceives integrating tablets into the classroom as a learning process for teachers and students. She believes teachers and students should always strive to learn from each other, promoting trust and respect. She uses tablets every other day for group instruction and individual feedback in the classroom. Her main challenges with integrating tablets stem from limited student knowledge of the programs and assignments. The critical advantage of tablet use is better time management, which requires integrating tablets into the classroom.

Finally, Participant 8 is a female 10th-grade science teacher with 11 years of teaching experience. In her school, tablets are transferred from room to room depending on which teacher needs them at a given time. Therefore, students learn how to use and care for tablets daily from the beginning of the year. Significant challenges are time delays for this participant, ensuring proper tablet use without monitoring each student, and Internet slowdowns. However, students appear more confident as there is more collaboration, whereby students share ideas and thoughts without too much distraction. In

addition, there is increased exposure to the outside world through new articles and research.

Data Collection

The study sample included eight participants, four from the United States and four from the UAE. Two interviews and a review of technology-infused lesson plans were used to collect data. Discussions were held via Zoom and telephone on dates and times convenient for and chosen by participants. I contacted participants via email to arrange the time and date for an interview via Zoom. Each interview lasted for approximately 60 minutes and was transcribed after using NVivo for each interview. After every interview, data was recorded using Zoom cloud recording. The original plan for this study was to collect data locally. After receiving permission from IRB and the local superintendent, I was introduced to the local school principals, who connected me with teachers. Interview offers came from every teacher except for STEM teachers. Therefore, following this circumstance, I requested and received permission from IRB to recruit participants via social media. It took 1 year to recruit participants for this study.

The phone interviews and Zoom interviews lasted for 60 minutes. At the beginning of the interview, I informed participants that their participation was voluntary. They had the choice to decline to answer any question and leave the study at any point. During the Zoom interview, most participants seemed relaxed and continued collaborating longer than necessary. After every interview, I recorded data using Zoom cloud recording. Zoom saves recordings to the cloud. After downloading the file, I

organized and transcribed the contents, imported them into NVivo, and transcribed them. I returned transcripts to participants for confirmation and validation. One transcript had to be returned to the participant twice for further consideration due to the individual's accent. Following confirmation, I imported data into NVivo for auto, thematic, and frequency coding. I also collected each participant's lesson plans via email. Both forms of qualitative data supplied insight into using tablets in the classroom, opportunities, and barriers teachers faced when implementing tablet use.

Data Analysis

The interviews were audio-recorded and instantly transcribed. The transcripts were firsthand-coded and analyzed for common themes. Inductive data analysis involves examining data, transcribing, transferring, analyzing, and interpreting commonalities into thematic relationships and patterns (Yin, 2014). To complete the analysis, I followed Creswell's (2015) five steps of analysis and interpretation of qualitative data: (a) collecting the data, (b) preparing data for analysis, (c) reading data, (d) coding and labeling data into segments, and (e) coding text for themes to in research reports.

I transcribed the interview data verbatim to ensure accuracy since it was still fresh in my mind, allowing for more accessible coding into categories and themes. The transcriptions were reread, correcting the inaccuracies while listening to the recordings. Coding occurred along with the lesson plan analysis. Using tools within the document, I noted similarities in phrases and words used by each participant. Lesson plans were analyzed and compared to the interview findings. As reoccurring phases occurred, codes

were assigned and recategorized to show themes within the data.

Using the open coding process, I highlighted words and phrases to form 200 codes. The method provided a general view of the information and resulted in 13 key themes (see Table 2).

Table 2

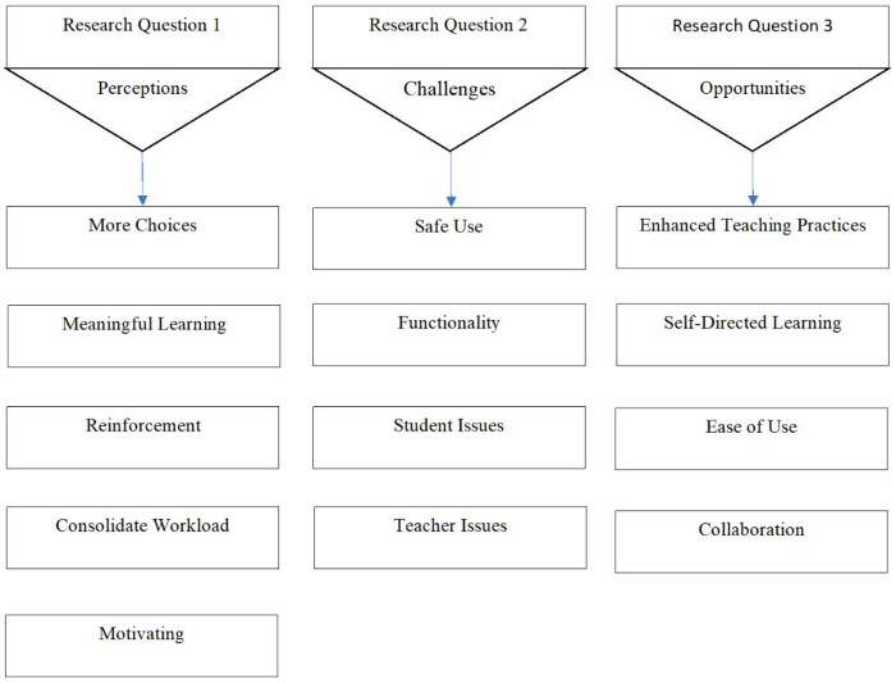
Themes and Characteristics

Themes	Characteristics
• More choices	• Tablets allow for more choices when working on assignments
• Meaningful learning	• Veteran teachers encourage students by integrating meaningful and purposeful lessons
• Reinforcement	• A review of the information
• Consolidate workload	• Consolidating workloads quickly
• Motivating	• Tablets can be motivating to use
• Safe use	• Setting restrictions to allow for safe use
• Functionality	• Tablets present more functionality
• Student issues	• Loss of login information, distraction, and browsing social media accounts
• Teacher issues	• Lack of resources, network problems, lack of preparation time, lack of training, and difficulty in close monitoring
• Enhanced teaching practices	• Tablets allow a variety of options for enhancing teaching practices
• Self-directed learning	• Adding teacher notes for students lead to self-directed learning
• Ease of use	• Easy and instant access to information
• Collaboration	• Tablets facilitate engagement and build positive relationships

I grouped the emerging themes from the interviews into folders and nodes. Along with meaningful phrases associated with the three research questions, The nodes consisted of a detailed collection of coded statements (Looney, 2018). I compiled questions' answers within each node, creating case nodes for each participant's information. With each query, relevant data appeared. The queries also generated word clouds made up of powerful words and themes. Figure 1 presents significant themes from the data and their links to the three research questions.

Figure 1

Research Questions and Themes



Note. This figure represents the themes that emerged from the data for each research question regarding perceptions of middle and high school veteran STEM teachers integrating tablets into the classroom.

Data Analysis Process

In his book. Yin (2018) argues that a practical qualitative analysis relies upon coding strategies. Merriam (2015) suggests that applying a coding method to evaluate transcripts is essential in recognizing the underlying patterns and themes. Yin emphasizes the importance of aligning the themes with the research questions. The research questions were the foundation for developing the interview questions and the theoretical and

conceptual framework. The data support the themes and are aligned with the research questions. The research questions were the basis upon which the interview questions were designed, and the theoretical and conceptual frameworks were based. Yin emphasizes the role of the theories in his study.

My research was conducted using NVivo, a tool used by researchers compatible with many file formats, including audio, digital photographs, e-mail, graphics, and text. I used NVivo to store the data and manage data organization, coding, and analysis. I asked that the participants send me the artifacts I asked for in each interview and technology-infused lesson plans. Each participant received a copy of the transcripts. Subsequently, each participant approved the transcripts and sent the agreed-upon artifacts.

The transcripts from the participant interviews were stored in NVivo. As coding continued, the interview questions served as nodes, and themes emerged. Meriam (2015) reported that coding is an iterative process and recommended that it occur after an interview. To track the frequency of the codes, I used NVivo. As the list of nodes and categories decreased, I decided to pare them down further. To follow the frequency of the codes, I used NVivo. Following a systematic merging of codes, I was able to find themes. As I reread the participants' responses, I aligned these themes with the primary purpose of the study, the framework, and the research questions designed to explore teachers' perceptions of integrating tablets into the classroom. Through my analysis of the transcriptions, I recognized patterns appearing and linked similarities found among the

interview data and artifacts collected from teachers. The triangulation of results from this study was also expedited through this methodology.

Lesson Plan Coding and Analysis

Teachers were asked to send a technology-infused lesson plan for review by their interview date. Every teacher sent a lesson plan for review. For data triangulation from the interview, each lesson plan was labeled with a participant's number. The lesson plan aimed to look for specific concepts associated with tablets. Analysis of lesson plans shows little to no tablet training in all lesson plans. All teachers organized lesson plans into instruction blocks of time and listed goals. An analysis of lesson plans revealed that teachers needed to know how to plan for tablet integration. NVivo's open coding yielded 655 codes based on interview data, leading to 13 themes. While open coding refers to regulations based on the data, NVivo coding is a qualitative data analysis method that emphasizes the actual spoken words of participants (Manning, 2017).

Table 3

Table Showing List of Themes

Research questions		Themes
How do veteran middle and high school STEM teachers perceive the process of integrating tablets into the classroom?	1. 2. 3. 4. 5.	More Choices Meaningful Learning Reinforcement Consolidate Workload Motivating
What challenges do veteran middle and high school STEM teachers observe when integrating tablets into the classroom?	1. 2. 3. 4.	Safe Use Functionality Student Issues Teacher Issues
What opportunities do veteran middle and high school STEM teachers observe when	1. 2.	Enhanced Teaching Practices Self-Directed Learning

integrating tablets into the classroom?	3. 4.	Ease of Use Collaboration

The table above displays a list of named themes before, during, and after data collection. They derived from a review of the literature presented in this study. These are based on the characteristics of the phenomenon under investigation: the perceptions of veteran middle and high school STEM teachers integrating tablets into the classroom. Various words and phrases were repeated during the coding process, forming these themes. The themes presented in this table were considered aspects of participants' accounts that captured their specific beliefs and experiences relevant to the research questions. As I tried to address the research questions, the themes appeared from my engagement with the text. They supplied a framework for describing the data and helped me make sense of the results.

Discrepant Cases

To account for any evidence of discrepancies, the data collected for this qualitative case study was carefully examined and analyzed. Interviews with teachers showed that the lack of training posed a significant challenge when planning and implementing pedagogical activities. One teacher, however, offered an alternative perspective. Participant 7 said

> There was no training for using them, but even though I had no training, the kids were tech-savvy and eager to learn. Although they were not used to the programs we were using, they were willing to learn as we progressed. Their attitudes

encouraged me. I told the students we would take this route to learn how to use our tablets, girl and boys. We started with the phones as we were getting the tablets set up. They were all familiar with using their phones.

After the task was set up, they had to get their tablets and return to their seats. I also learned how to schedule assignments so they could work from home. I gave them note cards that would be used on the test. They knew they were to look at the sites themselves. When there was a difficult concept, I would slow down and tell participants this was critical information. The hardest part is getting them to realize that they can be doing work at home with whatever they have. We all learned together as we tried each lesson. In the future, I hope to have a little more time to train and prepare myself to learn how to use the various programs. Teachers would receive help from training on the use of tablets.

When learning how to use technology with her students, participant 7 was overzealous. Her actions went beyond what a schoolteacher should do, given the limited time they must work with daily. It enhances my research's credibility, transparency, and trustworthiness to recognize and report this contrary evidence.

Evidence of Trustworthiness

By showing trustworthiness, I confirmed the study's credibility and contribution to the existing body of knowledge. I triangulated the data with each teacher’s lesson plans to develop credibility. I gathered data from participating teachers using Zoom semi-structured and teacher telephone interviews. To further prove the credibility of this study,

zoom interviews with teachers, telephone interviews with teachers, and artifacts were used as triangulation methods.

Credibility

According to Kalu and Bwalya (2017), a researcher's credibility is found by the consistency between the views expressed by participants and what the researcher represents as their views. A researcher's credibility is also measured by how well they show that an exact picture of the phenomenon being studied has been painted. The use of triangulation, member checking, satisfactory engagement, peer review, and discrepant case investigation is recommended to show data validity. Since the participants legitimately judged the credibility of the results, each participant reviewed their transcripts for clarification and returned them via email, thus assuring an exact fit between the participants' views and my representation of their opinions. I recruited participants from various locations throughout the United States and the U.A.E. to show credibility rather than a single local institution.

Transferability

A study's transferability is based on how well the findings apply to other situations. All good research should produce ideas and results that can be used broadly (Kalu & Bwalya, 2017). I presented research perspectives and assumptions to prove transferability or external validity. Moreover, I provided readers with "sufficient information about this study such that readers can establish the degree of similarity between the study and the case to which findings transfer" (Patton, 2015, p. 685). Most

importantly, the transferability of the outcomes from this study may affect future educational decisions about integrating tablets into the classroom. Finally, to further enhance the transferability of the study findings, I only invited veteran middle and high school STEM teachers who had access to tablets, used technology-infused lesson plans, and had been teaching for five or more years.

Dependability

In research, dependability refers to the stability of the findings and the researcher's attempt to consider proper changes in the phenomenon, design, or method. To ensure reliability, the researcher should provide the reader with enough details to determine whether the study and the researcher are dependable (Kalu & Bwalya, 2017). While showing reliability through data triangulation, I transcribed the interviews, proving dependability. Accurate records ensure the process "was logical, traceable, and documented" (Patton, 2015, p. 685). The study showed diverse perceptions.

Confirmability

Confirmability shows that findings are related to the data rather than the researcher's predispositions. Confirmability is achieved through data that is credible, transferrable, and dependable. The research process should be detailed to ensure the study's validity. Readers will better understand the dataset analysis procedures (Kalu & Bwalya, 2017). Objectivity was proven by transcribing data at once. Each participant checked and verified the transcripts for accuracy. To ensure that data and interpretations

were unbiased, I linked assertions, performances, and findings (Patton, 2015). Triangulation of the data reduced bias and increased confirmability.

Results

The results presented in this section were organized by 13 themes generated during the data analysis. Participants were asked several questions to gain their perceptions of using tablets in the classroom. In this section, I discussed the 13 themes.

RQ 1: How do Veteran Middle and High School STEM Teachers Perceive the Process of Integrating Tablets into the Classroom?

Theme 1: More Choices

There was consensus among the eight participants that tablets offer more choices. When asked how tablets supply more options, they used examples such as virtual field trips, research, reading and listening to books, presentations, note-taking, and quizzes. Participant 1 stated, “students can easily access resources, such as images and videos. This easy access can enhance their understanding of the topics. Additionally, participant 2 responded, “I love knowing that I can see each student’s understanding based on their responses to my lessons. They can give thoughtful, individualized feedback based on their digital answers.”

Also, participant 3 added, “students can utilize tablets at home and in the classroom, allowing them to become more creative.” Furthermore, participant 4 stated, “student data is more readily available for teachers and parents.” In addition, participant 5 responded, “they can research, type, and record their voices.” Further, participant 6

added, “students have access to more information quicker when using tablets than books.” In addition, participant 7 responded, “tablets offer teachers and students the opportunity to learn together simultaneously.” Finally, participant 8 added, “students have the option of being discrete when responding to projects they are working on.”

Theme 2: Meaningful Learning

Technology engages students in meaningful learning (Higgins & Bushell, 2018; Zainuddin, 2019). Technology use has increased in middle and high school settings, but the integrated technology types have not (Dong, 2018). Ihmeideh & Al-Maadadi, (2018) emphasize using technology when students engage with computer programs and work on specific skills. The eight participants agreed that tablets offer more meaningful learning. First, participant 1 stated, "we live in a technological age. Students must use more technology as they age, never less. Because of that, I think it is important to teach them how to utilize the tech to the best of their abilities." In addition, participate two added, "with all of the productivity tools, there are many ways that students can respond to an assignment digitally in a meaningful way. Tablets are just a method for getting my students online to collaborate or respond to lessons in a meaningful way." Similarly, participant 3 said, "all students can benefit from tablet instruction because students learn differently.

Students receive help from different learning styles using tablets, such as visual materials, music, drawing, etc." Furthermore, participant 4 responded, “Student data drive classroom instruction, and student performance is based on mastery of grade-level

standards and skills.” In addition, participant 5 stated, “students learn how to work together cooperatively as well as how to bring a design from an idea to something that simulates real-life engineering.” Participant 6 added, “students use tablets to research science topics and produce presentations, reports, videos, etc. that demonstrate their understanding of topics.” For the same reason, participant 7 responded, “yeah, tablets offer good learning experiences for both the teacher and the student.” Finally, participant 8 added, “students become more engaged in learning activities when using tablets.”

Theme 3: Reinforcement

Six responses showed that tablets allow students to reinforce learning. Participant 3 declared, "I am teaching students that tablets are a valuable extension of the learning process, used to review and reteach past lessons/skills. Most students already use tablets at home and know how valuable technology is in their everyday lives. Using tablets to reteach or review allows students to work at their levels and progress as they become confident in the material. Using tablets provides another strategy to help students who need additional math practice." Likewise, participant 4 added, "I have always integrated technology into my lesson plans by assigning students to a digital center. As students rotate, they effectively use technology to reinforce what has already been taught in the classroom by the teacher."

Furthermore, participant 5 said, “tablets allow students to reflect on their learning experiences. They spend more time thinking about what they have done and improving their work.” In addition, participant 6 stated, “when using tablets in the classroom,

students can observe another student who is doing the same thing they are and reflect on other options of ways to apply their learning." Likewise, participant 7 added, "when using tablets, students can manage crucial information and make sense of their learning experiences." Finally, participant 8 stated, "students can manage their learning by observing peer feedback and responding based on their understanding of the information."

Theme 4: Consolidate Workload

Eight participants said that tablets offer the convenience of condensing materials into one place for future review. Participant 1 observed, "tablets allow me and students to consolidate our workload; there are no papers to carry back and forth or for students to lose." In addition, participant 2 added, "rather than carrying around tablets filled with learning materials, they can find every assignment in one place." Likewise, participant 3 stated, "tablets are tools that can assist you in keeping everyone and everything moving forward at the same time."

Participant 4 emphasized that "parents can easily find students' assignments and teacher notes at a glance when using tablets." Participant 5 said, "in a world where everything is moving simultaneously, tablets are an invaluable tool for consolidating work." In addition, participant 6 said, "complex projects with multiple duties become smaller in scope." Likewise, participant 7 stated, "If you have a tablet, you can easily defer the less important tasks in favor of those more important." In like manner,

participant 8 added, “tablets allow me to schedule and manage student tasks in the same place.”

Theme 5: Motivating

The results from eight teachers showed that tablets lead to shared learning which often led to students motivating each other to learn more. Furthermore, participant 4 stated, "I encourage integrating tablets into the classroom since they motivate students to learn while allowing teachers to use data on student performance to design classroom instruction. They also motivate students by integrating meaningful, purposeful lessons."

In addition, participant 5 added, “before getting started, students often collaborate to develop a concept for their project.” According to participant 6, "students are very receptive and motivated to learn how to use tablets properly. I strongly believe that all students can receive help from tablet instruction, especially if it includes collaboration and incorporates topics that interest them. It is very motivating and engaging for students." Likewise, participant 7 said, “students collaborate in designing their ideas.” Participant 8 added, "Tablets increase student motivation and enthusiasm."

RQ 2: What Challenges do Middle and High School Veteran STEM Teachers See When Integrating Tablets into the Classroom?

Theme 1: Safe Use

Eight participants revealed that explicit sites are blocked when using tablets in the classroom; therefore, students can be assigned specific areas for assignment reviews. Participant 1 stated, "I teach students ways to efficiently care for the tablets in and out of

the classroom. I make sure to slow down my modeling so all students can participate. I also set firm expectations for using technology that never wavers." In addition, participant 2 advised, “teachers should make sure the features and apps they plan to use are appropriate for the age group they are teaching.” Likewise, participant 3 added that students are often afraid to explore new websites.” Participant 4 stated, “if possible, choose apps designed for educators and avoid freebies that may contain advertising.” Likewise, participant 5 added, “block any unsuitable websites and install a search engine with child-friendly filters.” In addition, participant 6 stated, “Decide whether it will be acceptable for students to use tablets for all parts of a lesson or only for certain activities” Furthermore, participant 7 added, “tablets should not just be used as a reward or a game.” In the same manner, participant 8 said, “encourage students to see the tablet as a tool to assist them in their learning.

Theme 2: Functionality

Responses from six teachers uncovered dysfunctional problems when using tablets. Participant 1 said, “when students, teachers, and staff use technology, the network can quickly become overloaded.” In addition, participant 2 stated, "there are times when the cursor will freeze while starting the tablet; they have to be turned off and back on to restart the process. The other problem occurs when the tablet cannot find the internet.” Likewise, participant 3 said, “tablets often crash, causing loss of information.” Furthermore, participant 4 said, “students often forget to charge their tablet.” Additionally participant five added, "there are occasions when the Wireless Fidelity (Wi-

Fi) does not work well. Sometimes the mouse freezes, and the student must restart." Finally, participant 7 stated, “the tablet has a way that if you are doing a test on it, they cannot open another browser. If you have a hard drive problem, you can lose everything. That would create a little bit of a problem."

Theme 3: Student Issues

Four participants’ responses revealed various issues when students try to use tablets. Participant 2 stated, "students have issues with logging in -- whether it is the tablet being unable to access the internet, or if it is a student who has forgotten his/her log-in information." Next, participant 3 added, “it is common for students to become malicious due to their curiosity.” In addition, Participant 4 said, “it is important to make students aware of cyberbullying since it is prevalent online.” Furthermore, participant 6 declared, "sometimes students are distracted by wanting to do things other than the assignment on their device. I try to address this by clearly telling the expectations for the assignment, showing students the time left to complete the work, and closely monitoring students while they are working. Sometimes students have disagreements with classmates when trying to collaborate on an assignment, but this presents a good teaching opportunity about working with others online."

Theme 4: Teacher Issues

Eight participants' replies from the interview exposed issues related to tablets in the classroom. Participant 1 said, “it is often not possible for teachers to undergo comprehensive school training.” In addition, participant 2 added, “integrating technology

into existing lesson plans often needs additional time.” Furthermore, participant 3 stated, “in most instances, availability of technology is limited.” Moreover, participant 4 said, “it is common for lack of expert technical staff, poor administrative support, and a poor course curriculum.” Participant 5 stated, “the most significant barrier to integrating tablets into the classroom is availability. A 1:1 would be ideal." Also, participant 6 said, “there is a need for teachers' ongoing professional development to model new pedagogies and tools for learning to enhance the teaching-learning process.”

Participant 7 added, "when I first began to teach tablets, it was somewhat of a challenge because I did not know how to use them. The students and I had to learn together simultaneously. There was no training for using tablets. You almost have to entertain students to get their attention." Moreover, participant 8 declared, "I am not very good at applying technology in the classroom, so I get most of my knowledge by asking my colleagues. During my first experience using tablets, I was unfamiliar with integrating every part of the lesson, from the questions included to the assessment. I come from a third-world country, Ethiopia, so exposure to technology was a problem. The right training and experience would have been helpful. Controlling students in every aspect was difficult. Sometimes students will open other windows while the teacher is teaching. It was difficult for me to engage students in my first few years."

RQ 3: What Opportunities do Middle and High School Veteran STEM Teachers Observe When Integrating Tablets into the Classroom?

Theme 1: Enhanced Teaching Practices

Six participants mentioned that tablets allow them to select and design various helpful strategies for instructional purposes. Participant 1 said, “the use of technology assists me in conveying information, for example, when I display notes or when I complete assessments for students.” In addition, participant 2 added, “I use technology to interact with mathematical objects such as graphs, algebraic symbols, geometric objects, and statistical displays, allowing students first-hand experience with those different mathematical representations.” Furthermore, participant 4 stated, "I integrate technology in my classroom five days a week for about 45 minutes to 1 1/2 hours per student/each day. The integration of tablets has enhanced my teaching practices by allowing students to learn independently through an online program. Learning independently promotes student achievement and increases student self-esteem."

Additionally, participant 5 added, " tablets have enhanced my teaching practices by allowing me to offer a variety of opportunities to my students. They allow for more interactive activities which hold students' attention. I am always looking for new ways to integrate tablets," Moreover, participant 6 said, “I have seen how technology-enhanced instruction incorporating visual elements can often help students better comprehend abstract mathematics.” Furthermore, participant 8 said they “use tablets to motivate and inspire students.”

Theme 2: Self-Directed Learning

Seven participants recalled how tablet use had inspired students to cooperate with their peers to complete assignments successfully. Participant 1 stated, "Students use technology at home much more, leading to more independence, self-discipline, and confidence in the learning process. It is, in my experience, an instant attention hook when using tech. Students want to participate, and better yet - they usually know how to do so efficiently." Participant 2 added, "once students log onto a tablet, they can log into their classroom where they have assignments waiting for them. It is helpful to have links embedded into the classroom assignment. Students can get right to work without mistakenly entering wrong website addresses."

Moreover, participant 3 said, “using tablets, students can connect with others, explore topics of interest, and participate in opportunities and events worldwide. Furthermore, tablet technology allows for new and more flexible ways to modernize classrooms, enabling students to organize their resources, adapt their learning styles, and study individually or collaboratively.” Additionally, participant 4 added, “in terms of developing and supporting self-directed learning, tablet technology has significant implications.” Consequently, participant 5 stated, “since students build their knowledge on tablets, they feel a sense of independence while learning, thus increasing their motivation to learn.” Moreover, participant 7 added, “using tablets keeps students engaged since they must learn on their own and apply it along with their skills to find solutions to problems, evolve their learning, and be encouraged to learn their entire

lives.” In addition, participant 8 said, “tablet instruction can facilitate self-directed learning. Tablets supply supporting elements that support the development of knowledge and skills. The teacher can impart instructions by modeling desired behaviors, supplying explanations and illustrations for concepts, allowing learners to take part in a task where the instructor acts more like a guide, and gradually withdrawing support to enable learners to take on more independence.”

Theme 3: Ease of Use

The teaching experience and the comfort of using tablets were positively correlated with teachers’ perceptions in a study conducted by (Sahin et al., 2018). Three participants’ responses from the interviews showed that tablets are popular with students because they are easy to use, portable, and offer countless features. They can be used in a variety of ways. Participant 2 stated, "It is also easier for students to respond quickly to a teacher’s question using a tablet -- I can use online websites and tools to record their responses for later analysis. It is much easier for teachers to check students’ progress and see what they are doing. The DOG cannot eat the homework!" Additionally, participant 3 said, “tablets can be used without fully understanding structure or how they work. With even a brief period of training - an hour or less - you can see the real potential in all features, rather than just those you stumble across.” Furthermore, participant 5 declared, "tablets are user-friendly. The students love to use them in any way. I try to use them as much as possible as we live in the age of technology. Positive opportunities have

developed because of the use of tablets. They are easy to operate, so the students enjoy using them for various projects."

Theme 4: Collaboration

Eight participants' responses to the interview questions suggested that tablets often support and enhance collaboration. Students can easily exchange ideas and explore concepts leading to rich interactions and collaborative skills. Participant 1 said, "there is a noticeably larger amount of collaboration in the classroom when using tablets. Students can share ideas and thoughts without too much distraction while collaborating. In addition, tablets are wonderful tools that help students model real-world applications." Participant 1 also emphasized that "students can create collaborative research groups for their classes where they can bookmark and annotate web-based resources and current events articles relevant to their course content." Participant 2 added, "students can use tablets to collaborate about upcoming assignments." Likewise, participant 3 said, "students can collaborate with other students as they encourage each other and critique their assignments." In addition, participant 2 stated, "students can collaborate on projects with others across the district, the country, and internationally." Furthermore, participant 3 added, "students collaborate and help each other during tablet use." Additionally, participant 4 stated, "students are helping each other more frequently when they use technology in the classroom, according to teachers." Moreover, participant 4 said, "tablet technology allows students to collaborate almost anywhere and anytime with the right tools and an Internet connection. It is also possible to track student collaboration

whenever you want to use technology. Students grow when they collaborate and collaborate to learn."

Furthermore, participant 5 added, "today's classroom is student-centered and collaborative. A crucial aspect of learning is working collaboratively with others." Likewise, participant 6 stated, "classroom collaboration can be enhanced by technology. A new learning environment can be created by allowing students to learn new topics with their peers." In addition, participant 7 said, "in collaborative learning, learners join their efforts, take the initiative, and work as a team." Finally, participant 8 stated, "tablets allow for collaborative learning, which is perhaps among their greatest advantages. They have been proven to be great tools for enabling collaboration."

Summary

In my dissertation, I examined the integration of tablets into the classroom from the teachers' perspective. Teachers displayed a cheerful outlook, believing that tablets are valuable tools for teaching. Despite their varying confidence levels, they could cope with the challenging learning environment. Three research questions guided the study's findings. Research Question 1 sought to find the specific perceptions of the teachers' process of integrating tablets into the classroom. This question led to 5 themes: more choices, meaningful learning, reinforcement, consolidated workload, and motivation. Teachers saw this process as necessary for the success of all students. Classroom instruction is driven by student data when using tablets, and student performance is based on understanding grade-level standards and skills. Participants are teaching students that

tablets are a valuable extension of the learning process, used to review and reteach past lessons/skills.

All eight participants agreed that tablets are user-friendly, and the students love to use them in any way. Teachers try to use tablets as much as possible as we live in the age of technology. Teachers also think that students receive help from having tablets available because they can easily access online resources, such as images and videos, which enhance their understanding of the topics they are studying. Tablets also allow students to collaborate on digital projects easily. Teachers say that students need loads of instruction and support in the proper and effective use of tablets. Still, students are very receptive and motivated to learn how to use the devices correctly and willing to help their peers once they learn a new skill. The participants agree that using tablets in the classroom has been a positive experience for students and them. Teachers' positive attitudes have led them to find creative and novel ways to expose students to tablets, despite the scarcity of tools.

Research Question 2 was to discover teachers' challenges when integrating tablets into the classroom. The response led to safe use, functionality, and student and teacher issues. In addition, teachers revealed that no training was offered for integrating tablets into the classroom. They also said that availability is one of the main barriers to integrating tablets into the classroom. For these reasons, they often have students work in pairs or rotate so everyone can receive help from the learning process. Significant challenges include time delays and ensuring students use the equipment appropriately

without constantly watching them. Students often have trouble finding safe, friendly, relevant websites, and teachers must research outside of class before presenting lessons. Sometimes, students have a problem with a tablet, and teachers need to send a help desk ticket. The process is time-consuming. Also, using tablets can be challenging if extra activities are assigned on certain days. Teachers communicated that it is challenging when tablets malfunction, especially if they do not have a full-time technology assistant. They explained that students are sometimes distracted by other things while using their devices instead of working on an assignment. Teachers suggested that they must entertain students to get their attention. The solution teachers use involves clearly explaining the assignment's requirements, explaining the time allowed for students to complete it, and closely watching students as they work. Results also revealed that, occasionally, students disagree with each other when collaborating on an assignment, but this offers a worthwhile teaching opportunity about working with others online.

Research Question 3 addressed the opportunities teachers attested to when integrating tablets into the classroom. The participants agreed that the significant opportunities they saw were enhanced learning practices, self-directed learning, ease of use, and collaboration. In addition, they decided that tablets make it very convenient to leave student feedback on their work quickly and easily. Teachers mentioned that students had received help from sharing their work easily with them and with other students. They specified that articles, images, and videos about studied topics and topics

of personal interest are available to students. Students can be taught good research practices, such as finding reliable sources and giving credit to their sources.

The participants fully agreed that there is a noticeable increase in collaboration when tablets are used in the classroom. They agree that there is more opportunity for students to share ideas and thoughts without distraction. They asserted that students could also gain exposure to the outside world through articles and research. The participants also specified that all these things would contribute to helping their students succeed more in middle school. Teachers agreed that since students are tech-savvy, they often learn more about the tablet and various websites from the student. The study results were described in Chapter 4 and explained in Chapter 5. The conclusion, interpretation of findings, implication for social change, and recommendations for future studies are discussed in Chapter 5. An interpretation is specified based on the findings, and the extent of knowledge revealed. Also, in Chapter 5, themes relating to research questions are linked to themes from literature. Recommendations are made based on the limitations and strengths acknowledged. I discussed the implications for positive social change in society. Additionally, this study concludes with a strong take-home message.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this qualitative study was to explore the perceptions of eight middle and high school grade veteran STEM teachers integrating tablets into the classroom through the lens of the TPACK model and improve the integration of tablets in the school based on participants' feedback through interviews and documents. Qualitative research was used because it emphasizes natural meanings with an interpretive and realistic approach to its subject matter (Denzin & Lincoln, 2000). Some of the key findings of the study were (a) veteran teachers perceive that tablets must get students' attention, (b) veteran teachers encourage the integration of tablet technology into the classroom, (c) they integrate meaningful, purposeful lessons, and (d) the majority meet weekly to discuss student data and ways to improve instruction. Various opportunities found were (a) tablets have enhanced their teaching practices, (b) tablets allow students to manage content better, (c) tablets allow students to collaborate, and (d) they are easy to use.

In response to the first research question, which sought to identify the perceptions of teachers who use tablet technology in the classroom, the following key findings emerged: (a) veteran teachers have positive perceptions, (b) teachers perceive that nowadays, you almost must entertain students in the classroom to gain attention, (c) the classroom activities are enhanced by tablet technology, according to teachers, (d) there is a sense of confidence among teachers in their abilities to utilize tablets, and (e) tablets are

viewed as an essential tool by teachers. RQ 1's themes focused on teachers' perceptions and how tablets were used as a tool to help facilitate learning.

RQ 2 focused on access challenges and teachers' observance, which are the most important to teachers. Teachers' biggest challenges in the classroom were a lack of training and equipment. Therefore, teachers need technical support to use tablets effectively. In RQ 3, teachers reported opportunities they saw and their viewpoints on using tablets in the classroom. According to the RQ 3 themes, tablets can be used to design instructional strategies that promote collaboration and allow participants to select and use helpful instructional strategies. In the following sections, the findings are interpreted, limitations are discussed, recommendations are made for future research, and the implications are discussed.

Interpretation of the Findings

Educators need to use technology effectively to realize the benefits of technology. Education depends on how educators can use technology to their advantage in the classroom (Bernard, 2022). To implement modern technology successfully, school districts must ensure that teachers receive the training and support they need. It has been found that teachers' beliefs and attitudes about technology's place in teaching and learning influence their use of technology (O'Neal et al., 2017). It has been documented that intrinsic teacher factors and technology integration in the classroom is related (Dolan, 2016; Ertmer, 2005; Ertmer et al., 2012; Heath, 2017; Ottenbreit-Leftwich et al., 2018; Salam et al., 2018). However, technology has yet to be formalized as a pedagogical

tool in the 21st century (O'Neal et al., 2017). The U.S. government has made notable strides to include technology in middle and high schools about accessibility (Alizadeh et al., 2017; Fernandez et al., 2018; Tsetsi & Rains, 2017; Wamuyu, 2017). As a result, the federal government invested billions of dollars into installing Internet and network infrastructure in public schools and equipping each facility with laptops and other technological tools. As schools become increasingly technologically advanced, students will be better able to compete in a rapidly changing global environment (Kormos, 2018) by preparing them for college and careers. But having technology in the classroom does not guarantee that teachers will use it to help with learning (Kormos, 2018).

This study showed that training and support are the primary reasons for the stalled use of technology in the classroom. Analyzing the results concerning the research questions will allow a comparison to be drawn with the earlier literature. During the data analysis phase, 13 overarching themes appeared: (a) more choices, (b) meaningful learning, (c) reinforcement, (d) consolidated workload, (e) motivating, (f) safe use, (g) functionality, (h) student issues, (i) teacher issues, (j) enhanced teaching practices, (k) self-directed learning, (l) ease of use, and (m) collaboration. The findings in this research support and expand on the sources previously discussed in Chapter 2, which in turn supplies insights into the results accordingly. The following research questions were addressed:

Research Question 1

How do veteran middle and high school veteran STEM teachers perceive the process of integrating tablets into the classroom? This question resulted in five themes. These themes are discussed in the following sections.

Theme 1: More Choices

Technology has allowed teachers to take a student-centered approach instead of a teacher-centered one. There was a significant reduction in the time spent teaching students in front of the class. Student interactions have changed quite a bit over the years. Teachers are no longer required to stand and present their lessons in the classroom. There has been a significant reduction in teaching. The eight participants agreed that tablets offer more choices and learning options. Current literature supports these findings. The teaching experience and the comfort of using tablets were positively correlated with teachers' beliefs in a study by Sahin et al. (2018).

Theme 2: Meaningful Learning

Technology engages students in meaningful learning (Higgins & Bushell, 2018; Zainuddin). According to my study, five participants stated they used tablets to enhance and introduce students to self-directed learning. My findings extend those of researchers like Monem et al. (2018) and Flewitt et al. (2015). Similarly, previous research has also revealed that teachers rely on tablets for science lessons when students actively study independently (Aflalo et al., 2018).

In my research, teachers attributed maximizing the use of the limited tablet technology in their classrooms to their faith in technology's value. Eight participants agreed that tablets offer a more meaningful learning experience. The computer visual display developed students' fine motor skills (Alavi et al., 2016; Mittoo, 2021). In addition, students can make more informed design changes by viewing the results on a computer screen (Chu et al., 2015). Using multiple programs, teachers could expand learning and teaching in new ways by using computers, integrating computers and tablets (Chu et al., 2015).

Theme 3: Reinforcement

The teachers said that students could also reinforce learning more with tablets. Some students already use tablets at home and how valuable they are in their everyday lives, so tablets provide another way to help students with their learning (Kim et al., 2019). Using tablets for reteaching or reviewing allows students to strengthen their levels and progress as they gain confidence in the material. Teachers have turned to the Internet to find tablet activities to reinforce students' learning styles (Karim et al., 2019).

Theme 4: Consolidate Workload

Tablets can consolidate teachers' and students' instruction (Tan et al., 2018). In my analysis, participants used tablets to reinforce, consolidate, and support student learning styles. Table technology also enabled participants to share teaching and learning materials with students through online platforms. The use of tablets has led to the disappearance of paper resources. With online platforms such as Google Classroom,

teachers can support student learning in a way that is impossible with traditional paper-based methods. In addition to comparing and contrasting students' work in real-time, participants said substituting technology for paper for assignments helped them save time. It is always a priority to reduce the consumption of paper among participants. With the tablet, teachers can access online collaboration platforms and reduce reliance on paper. According to several participants, tablets supply condensing materials conveniently into one place for future use. The participants agreed that tablets are tools that can aid them in keeping everyone and everything moving forward simultaneously. Participants also shared that a parent could find their children's assignments and teacher notes when using tablets. Participants mentioned that tablets are an invaluable tool for consolidating work in a world where everything changes simultaneously. Educators can easily defer the less important tasks to those more critical when using a tablet.

Theme 5: Motivation

In my study, I found that teachers assessed the quality of tablets based on their students' motivation when using them. The teachers also evaluated tablets based on how motivated students were to use them. Several STEM teachers noted that they could enhance instruction, student motivation, and learning by knowing the quality of tablets. This could help them expand and improve their projects. This could help students develop and enhance their projects. A recent study found that students' motivation in school increased when technology was used (Miller, 2018). In addition, teachers agree

that tablets motivate students to learn while enabling them to watch students' performance and plan instruction accordingly.

As a result of digital literacy, students have also been found to be more motivated to read. Parents and students have also been significantly more motivated to read or interact with the text when allowed to interact with digital readers (Ozturk & Ohi, 2018). Using technology for academic purposes increases student motivation to complete tasks (Hietajärvi et al., 2019). Students who use technology daily in the classroom are significantly more motivated to learn (Shtepura, 2018). Students have reported being more excited when using technology to complete assignments (Higgins & Bushell, 2018; Zainuddin & Perera, 2019). In the current study findings revealed that teachers perceived integrating tablets into the classroom as optimistic. Even with limited technical support and training, teachers in this study found creative ways to incorporate tablets into their daily classroom activities. Incorporating collaborative learning in tablet instruction can help all students, mainly if the topics are interesting to them and incorporated into the curriculum.

Research Question 2

What challenges do middle and high school veteran STEM teachers observe when integrating tablets into the classroom? This question resulted in four themes. Those themes were as follows:

Theme 1: Safe Use

All participants reported the safe use of tablets. Teachers said that if students are correctly and consistently managed while using the tool, it is very safe to use for projects. My study extends on Flewitt et al.'s (2015) findings about the safe use of IPads by teachers and students with disabilities in three British Commonwealth schools. Based on According to the Digital Promise Organization (n.d.), The U.S. Congress-originated teachers should set up an approval process for all school/district technology, software, and websites. A strategy should be followed to ensure that these digital learning resources are proper for age groups, aligned with pedagogy and curriculum, and follow federal, state, and local privacy laws. Information about approved software and websites, and the process for updating them, should be made available to teachers. Protecting student privacy and security should be taught to teachers and staff. The administration should ensure that teachers and staff have only the information and statistics they need to do their jobs and that students can only access appropriate content on school devices inside and outside the classroom. Teachers were informed to implement internet content filtering.

Theme 2: Functionality

The participants in my study evaluated tablets based on their comfort level and performance. However, my findings contradicted Al-Abdullatif and Alsaeed's (2019) study, which showed that most teachers could not assess the quality of instruction provided by tablets. Among eight participants, the tablet was easy to use and did not

require intervention or support. A learning curve was experienced by seven of the eight participants in implementing the tablet, but they said it was an effective device. In my study, participants said that using tablets to download learning platforms to accommodate students' learning styles was beneficial.

In addition, all eight respondents liked the tablets since the tools gave students greater independence. Three participants also reported that tablets were helpful in their learning process. According to Chin et al. (2019), tablets can sustain educational growth when they function correctly.

Theme 3: Student Issues

In my study, participants noted that to figure out the issues students were experiencing when interacting with tablets, they conducted assessments of their student's ability to conduct research, projects, and presentations to understand concepts, formulas, and problem-solving across the curriculum. When students show low performance, their suitability for using tablets as learning tools is assessed by their learning styles, which requires revisiting the choice of more suitable means for their learning abilities. In this study, STEM teachers reported using tablets to prepare students based on their learning insecurities to make learning fun, share with their learning groups, and enhance the learning process.

Konokman and Yelken (2016) found that teachers did not consider students' learning experiences when planning lessons. In Dooley et al.'s (2016) study, teachers needed to be aware of the importance of incorporating students' experiences into tablet

lesson plans. The network would become overloaded. The cursor would freeze, and the tablet could not connect to the internet. Students often need to remember to charge their tablets. Participant 1 stated that there were times when the mouse would freeze, the (Wi-Fi) would not work, and students had to restart the tablets. The responses of participants revealed some issues when students tried to use tablets. Students had trouble logging in -- whether it was a tablet not being able to access the internet or a student had forgotten their log-in credentials. Cyberbullying was widespread online, and students would become distracted by wanting to do other things besides the assignment.

Theme 4: Teacher Issues

Most teachers reported needing more experience designing lesson plans, projects, and other learning materials using tablets. Research question two examined how the challenges teachers saw affected the integration of tablets in the school. According to Sousa et al. (2017), teachers could not assess the quality of the tablets they used for instruction. Participants also agreed that the tablet needed a sturdy case to protect the tablet when dropped or thrown. According to the interview questions related to this research question, teachers had not received any training from technical support or the district. This study found that the usability of tablets in the classroom was limited based on the responses of teachers interviewed. Tablet carts often had to be surrendered to other teachers so their students could be prepared to use them. In addition, tablets can be disruptive if the teacher does not effectively manage students. The responses from six teachers revealed problems with tablets.

Issues relating to tablets in the classroom were revealed in the responses of eight participants. The most significant was availability. The cost of tablets was one of the most significant impediments to introducing tablets in the classroom. It was implied that there is a need for professional development to focus on modeling new pedagogies and tools to improve the teaching-learning process.

Research Question 3

What opportunities do veteran middle and high school STEM teachers see when integrating tablets into the classroom? This question resulted in four themes. Those themes were as follows:

Theme 1: Enhanced Teaching Practices

Tablet access influenced how instruction is delivered, according to participants. Furthermore, tablets enabled participants to improve their professional practice and enhance personal productivity. The laptop contributed to positive beliefs for both middle school and high school students. Supplying a valuable instructional resource enriches the learning environment because teachers appreciate the school's resources. Among the words participants used to describe their experiences with tablets, they included "transformative," "revolutionary," "positive," "convenient," "beneficial," and "empowered." In support of the impact of tablet technology on personal productivity and professional practice, participants shared workplace and unique experiences. Arkian et al. (2017) found that teacher training and professional development can affect how they use technology in the classroom through interviews, observations, and collecting artifacts.

Apprehensive teachers became more eager to try new technological approaches as attitudes and beliefs about technology in the school changed.

According to Voongkulluksn et al. (2018), “teachers' beliefs about technology are proximal to how technology is integrated into the classroom” (p. 71). Technology is more commonly implemented by classroom teachers who adhere to constructivist teaching philosophy (Alt, 2018; Farjon et al., 2019), noted that much decision-making goes into deciding what technology to incorporate in the classroom and what technology to include in the school. However, Smith et al. (2017) used a comparative case study approach to examine how middle and high teachers make technology-related decisions when teaching the same content. Twenty-seven teachers in six schools were interviewed, seen, and documented using multiple data sources. Three themes appeared from the data analysis concerning the use of technology by teachers. A teacher's pedagogical ability, a student's perceived ability, and time were all factors.

Theme 2: Self-Directed Learning

According to my study, three participants used tablets to enhance and introduce students to self-directed learning. My research findings extend those of Monem et al. (2018) and Flewitt et al. (2015). Monem et al.’s study found that the interventions used led to student self-directed learning gains. In their research, Monem et al. (2018) also found that their results converged with those of Harmon (2011), Haydon et al. (2012), and Neely et al. (2013). The studies showed tablet participants proved more significant self-directed learning gains in reading and math. Flewitt et al. (2015) found that IPads

boosted children's concentration levels across all settings. Ipads are highly effective tools for getting children to concentrate independently, enhancing self-directed learning while engaging them in work. The novelty of the apps played a role, but we have also seen similar effects after iPads had been available for a more extended period (Flewitt et al., 2015).

Aflalo et al. (2018) also confirmed the result of my study. During a study by Aflalo et al. (2018), participants stated that tablets had enhanced their students' self-directed learning. Their study also revealed that teachers rely on tablets for science lessons when students actively study independently. According to this study, some teachers utilized tablets to enhance self-directed learning using apps and learning platforms. Tablets were used during the COVID pandemic to share screens for online classes, enabling students to learn at their own pace and experience real-life situations for completing tasks. PowerPoint and Google Docs were also used to differentiate instruction in small groups and promote self-directed learning. iPads were used for online curricula, which enabled self-direct learning activities step-by-step. Further, teachers explained that slides provided texts, images, and videos for self-directed learning. By sharing their knowledge, students contributed to the lessons.

Subsequently, Voogt and McKenney (2017) noted that tablet technology had been positively associated with increasing knowledge among students. Thus, encouraging self-directed learning. With the support of the tablet, students could understand complex words. According to a study by De Vita and Verschaffel (2018), teachers used tablets for

self-directed learning. Also, my study found that participants used tablets for self-directed education and participation. In Palladino and Guardado's (2018) study, teachers also used tablets for creative learning. My research confirmed Palladio's and Guardado's findings, as participants preferred tablets for self-directed student-centered learning.

Theme 3: Ease of Use

My study showed that tablets combine laptops and handheld devices and can be easily used to create and learn content. The study confirmed the findings of other research studies. Multiple qualitative research studies were analyzed (Jones, 2017; Kilickava, 2019; Kirikcilar & Yildiz, 2018; Munguia, 2017; Palladino & Guardado, 2018; Ya-Huei-Lu et al., 2017), the authors noted that teachers consider tablets as being easier to use than books and paper. There was a time when teachers ran book-based assessments. Using sheets of paper, teachers would enter the data, analyze it, then feed it back to the students. Tablets have increased the depth, quality, and quantity of information. Four participants noted that they could design proper learning interventions to improve student learning based on the speed of data analysis and the timeliness of feedback. All participants reported tablets for their ability to help track students' progress and performance and speed and quality of feedback. A study examined teachers' decisions about what software to use when including tablets in their classrooms.

Theme 4: Collaboration

Eight teachers found that tablets lead to shared learning, which often led to students motivating each other to learn more. Participants discussed the potential for

students to form collaborative research groups for their classes where they can bookmark and annotate web-based resources and current events articles relevant to their course content. Additionally, it was pointed out that students can collaborate on upcoming assignments with tablets. One participant lamented that students could collaborate with others, encourage each other, and critique one another's work. Tablets also motivate students by integrating meaningful, purposeful lessons. In addition, before getting started with their assignments, students will often collaborate to develop a concept for their project. The teachers found that students are very receptive and motivated to learn how to use tablets properly. All students can receive help from tablet instruction, especially if it incorporates collaboration and covers topics that interest them. Students can also collaborate while designing ideas. My study's results confirm those of Flewett et al. (2015). Staff from all settings commented on children's collaboration around the iPad: they shared activities, took turns, supported one another's learning, and celebrated one another's success often and patiently. Students could build on this spirit of collaboration by sharing their achievements. During iPad use, the more knowledgeable children helped their peers often, and the staff commented on how the iPad stimulated and enhanced language and communication. As well as offering pictures and icons alongside or in place of words, iPads offered rich possibilities for creative communication across modes and media. Communication and collaboration were enhanced in whole-class and small-group activities for quiet children, children with English as an added language, and children with motor difficulties.

Singhavi and Basargekar (2019) also said that using technology in education is one of the essential tools to mitigate collaboration. Technology encompasses any device or application, including cellular phones, computers, tablets, network hardware, and software. Technology also includes countless services and applications associated with their use of them. Remarkably, students can collaborate with others and offer encouragement and criticism to each other. Moreover, the use of tablets for collaboration is suggested for upcoming assignments. According to the participants, students must collaborate, encourage, and critique each other's work. Also, students often collaborate before starting their projects while developing a concept. In addition to designing ideas collaboratively, students can also ask for help from each other.

Limitations of the Study

I used a case study approach to examine middle and high school STEM teachers' perceptions of integrating tablet technology into the classroom. Certain inherent limitations of the primary qualitative interview method may have hindered my study. Various factors limited the study due to planned strategies for implementation for credibility, transferability, dependability, and confirmability. Despite this, the qualitative case study approach limited this study to the experiences and perceptions of participants. Additionally, the limitation of recruiting volunteers could have affected transferability due to the number of participants. The researcher used social media forums to recruit volunteers. Two UAE volunteers decided not to participate as time zone differences and job responsibilities prevented them from being interviewed.

A logistical challenge changed the focus of the research. As a result of the COVID-19 pandemic, I had to change my planned methods for collecting data. The overwhelming workload of teachers' jobs nearing the end of a school year prevented four volunteers from participating in two 30-minute interviews. The interviews consisted of a 30-minute phone interview and a 30-minute Zoom audio interview. The two interviews for each participant lasted for a total of 60 minutes. In-person interviews were replaced by phone and online discussions for data collection. There might have been a compromise in the trustworthiness of participants' answers due to the absence of an in-person one-on-one interview. Initially, I planned to choose ten teachers from local schools. Alternatively, I had to seek participants outside the United States to obtain the eight selected participants. As part of the method, eight teachers were selected for interviews to ensure that the data was collected in-depth. One month after posting my recruitment invitation, I reached the number of eligible participants (eight) that met the inclusion criteria. My invitation was withdrawn from social media, my data collection time plan was not exceeded, and I focused on data collection.

In addition, participants were interviewed by phone and in a virtual room using Zoom. All the teachers were educators at the middle and high school levels. Due to the small number of participants, eight teachers, the generalizability of the study is limited. The transferability of the conclusions of this qualitative case study is limited because the total number of participants represented in this study equates to only a tiny percentage of educators' findings.

Recommendations

During this study, I collected invaluable information about the use of tablet technology in the classroom by middle and high school veteran STEM teachers. I want to supply nine recommendations for future research. The first recommendation is to provide teachers with direct activities to develop their skills and further integrate tablet technology into the classroom. Similar studies could be conducted using alternative data collection methods based on my research. The second recommendation is to recruit more participants who could supply more data for detecting patterns if more than the minimum number of participants are recruited. By triangulating data from multiple sources, data reliability can be improved by collecting, analyzing, and cross-checking the results. These findings could guide future research to decide whether participants' perspectives in this study differ from those of teachers in a local school district. The third recommendation is that in future research, researchers should show how teachers can use multimedia and technology tools to improve instruction, achieve curriculum goals, and engage all students (Williams & Beam, 2019).

The fourth recommendation is to include teachers from other content areas, not just middle and high school veteran STEM teachers. Each semester, administrators can create workshops where content-specific teachers can collaborate with tablet technology to create innovative and impactful lessons. Typically, teachers return to campus one week before students arrive. Time is essential when collecting data, so the researcher and the participant should meet at the right time. The interviewer's facilitation of the interview

and the time of the school year should be considered when deciding a reasonable time. In half-day sessions, administrators can allow teachers to share ideas and strategies for implementation in their classrooms.

Further research is needed based on the results of this study and the study's strengths for further investigation. By conducting such a study, schoolteachers and leaders could better choose which technologies are best used in classrooms. It could also affect how tablet technology impacts students at various levels of learning. Fifth, more research is needed on using tablets in teaching and learning to increase student learning. It could also affect how tablet technology impacts students at diverse levels of education. Tablet technologies become less challenging and more routine once teachers have a solid grasp of subject matter, pedagogy, and technology and know students, interests, and learning needs.

Furthermore, my study was one of the first to examine veteran middle and high school STEM teachers' perceptions about the integration of tablet technology. The sixth recommendation is that future research should consider studies with larger sample sizes, including studies exploring what veteran high school STEM teachers in various schools have to say. This study involved teachers from schools in the United States and the United Arab Emirates. The seventh recommendation is that future research explores the perceptions of high school teachers working in various parts of the United States. Findings from this study could help lay the foundation for future research. In this study, it

was found that tablets are used in a meaningful manner. It may be worthwhile to examine factors further to help integrate tablets more effectively.

Implications

Kurt et al. (2019) said that learning to integrate technology into instruction still is a priority for all who can gain from it. Positive social change resulting from this study may contribute to the academic and social development of the educational field (Office of Educational Technology, 2017). To realize the educational benefits of digital tools, all educators must be able to implement them into their instruction (Kurt et al., 2019). Segal and Heath (2020) suggested that educators develop a deeper understanding of integrating technology tools into their classrooms. Participants may benefit from sharing their knowledge to create a breakthrough in pedagogy and content using tablets as classroom learning tools. It would be incredibly beneficial for teachers to know how to use tablets effectively, how they relate to students' learning backgrounds, learning styles, and different learning models, and how they promote learning. In contrast, students enjoy using them in the classroom. In addition to knowing how tablets affect students across the curriculum, school administrators can supply technology infrastructure for their schools and train their staff in using technology tools such as tablets in the classroom.

The results of this research study have the potential for positive social change. My goal in endorsing a social change in the school is to bring mindfulness of the significance of and opportunities of integrating tablet technology. If offered the chance to gain experience with innovative technology tools such as tablets, teachers can provide better

aid to students by implementing current research-based procedures incorporating tablet technology to aid students in excelling in college and career readiness. Social change can be achieved by rethinking tablet technology and its impact on education. Various positive societal changes can be attributed to the results of this study, teaching, training, and technical support.

As one of the first sectors to adopt technology, education has created opportunities for learning and meeting the high demands of the 21st century. As 21st-century education progresses, TPACK teaching and learning models must be explored more with a focus on pedagogy, content, and technology (Koehler et al., 2017). Schools can use the TPACK model to integrate tablet training for all teachers. Teachers might better understand the TPACK model and the lens if tablets are integrated into the curriculum. With the TPACK lens, tablets can effectively enhance teaching practices. Expert technology teachers can mentor veteran middle and high school classroom STEM teachers on integrating tablets in simplified ways for improving learning. Sharing teachers' knowledge of tablet use may open new doors for educators to use technology in meaningful ways to enhance skills and academic performance to help learners and contribute positively to society. Technology teachers could take the initiative to share their experience and knowledge of these tools.

In addition to contributing to interactive sessions about tablets as essential tools for practice, technology teachers can hasten workshop learning styles and challenges. In lesson planning, technology teachers may help other teachers select tools based on

students' learning styles. In the classroom, expert technology teachers can also help teachers find what technological tools best suit students' learning styles and include personal background information to improve student learning experiences. Educators in the classroom might be better able to use technology as tools to enhance instruction and active learning in class if teachers shared a better understanding of the tools.

The results of my research may also contribute to positive social change through improved teaching practices. The impact of this study may guide schoolteachers and district leaders in developing policies, protocols, and training and professional development for teachers. McCarthy et al. (2017) mentioned that the technological needs of teachers are personal, contextual, and diverse. Specifically, teachers require customized professional development embedded within their work, supported by proper individual access to technology and time to learn and contribute.

The data revealed that teachers need more support from leaders when implementing technology to help students succeed. The study showed how schools' limited training and technical support affect how teachers integrate tablets into the classroom. However, before this study began, little was known about the perceptions of middle and high school veteran STEM teachers integrating tablets into the classroom. In more schools, teachers may be trained to incorporate digital technology in the school, such as tablets. With tablet technology as a teaching tool for technology integration, my study may contribute to positive social change by influencing the adoption of tablets as a teaching tool for education. Furthermore, my analysis may enhance a deeper

understanding of teachers' beliefs about lab technology training and support at the middle and high school levels. As a result, school and district leaders should consult with teachers to make tablets more available and give training and professional development to affect positive social change.

Eight participants reported no support from their school district for professional development. Furthermore, teachers were not supported, and their knowledge was shared with other teachers. Thus, this study shows that there can be social change when teachers engage in professional development activities and lead professional development initiatives to share their knowledge with colleagues. Further, school districts and schools could hire teachers with tablet computer experience to train new and struggling teachers. The results of this study may help school leaders understand the importance of teachers' input when selecting technology for classroom instructions tailored to students' needs. Therefore, school leaders may create a committee to gather teachers' opinions about new or current technologies that could affect a student's success.

Conclusion

This study reviewed the veteran STEM teachers' perceptions of integrating technology such as tablets into lessons. Interviews with eight veteran STEM teachers supplied the basis for the data presented in this study. Perceptions, knowledge, and strategies were examined among veteran STEM teachers who used tablet instruction in the classroom. In this qualitative case study, I discussed how veteran middle and high school STEM teachers are unprepared to integrate new tablet technology into their

classrooms as effectively as possible. This study adds to preceding studies that have examined factors that affect technology integration in the school. In this case study, the teachers displayed attitudes and beliefs characteristic of positive educators.

The findings of this study implied that teachers had positive perceptions of using tablet technology in the classroom. When given access to tablets, participants needed more training and technical support to be confident in their abilities to use them. The data gathered was triangulated with feedback from a zoom interview, phone interview, and artifacts provided by the teachers. In this study, the sample size of teacher participants was minimal, so the results may not be generalized and are likely to be transferrable only to similar populations and settings. Alternatively, the current study could foster social change within the education system by promoting tablet use. Furthermore, with the evidence provided in this study, schools can make informed decisions concerning how to train teachers to use tablets effectively.

As technology teachers used tablets in instruction, they revealed knowledge that could be used to enhance pedagogy and content by all educators. Middle and high school veteran STEM teachers reported that tablets helped improve learning. Teachers used iPads, apps, learning platforms, online programs, and software to enhance pedagogy and content. Teachers said that students who took technology classes showed that problem-based and inquiry-based learning was supported by the creative use of tablets while learning. To design and implement quality instruction, teachers can share their valuable knowledge with other classroom teachers. They used tablets as tools, and technology

teachers designed and implemented quality instruction using the TPACKs. In using tablets as a tool choice, teachers used the TPACK lens to simplify complex learning materials for various learning styles and levels. Veteran classroom STEM teachers and students can receive help from the significant areas in instructional planning shown by other technology teachers. Investing in technology policies and professional development training for educators using technology tools such as tablets could help principals, school leaders, and stakeholders.

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Appendix A: Interview Protocol

Date:

Time of Interview:

Interviewee (Name):

Interviewee Position: Veteran STEM Teacher

Interviewer: Joanie Rice, a doctoral student at Walden University

Case study: Perceptions of Veteran Middle and High School STEM Teachers Integrating Tablets into the Classroom

Description of the study: This study aims to understand veteran teachers' perceptions of integrating tablets into the classroom. This study will help other veteran teachers who wish to improve their tablets use.

Introductory Protocol

I would like to audio record our conversation today to accommodate my notetaking. Is that all right with you? The only people with access to the recordings will be my committee members and me. I destroyed recordings after transcription. It will be necessary to sign a form that meets human subject requirements. The document states that 1) the information is confidential, and 2) you have volunteered to participate. Moreover, you may choose to stop any time you feel discomfort, and 3) no harm will be inflicted.

I want to thank you very much for your participation. The interview will last no longer than one hour. I have several questions to cover during that time.

Introduction

Please participate in this study since you identify as a veteran middle or high school STEM teacher interested in integrating tablets into the classroom. This research project, in its entirety, focuses on improving the perceptions and practices of veteran teachers integrating tablets into the classroom. This study will not evaluate veteran teacher techniques. Instead, to learn more about their perceptions and practices of integrating tablets into the school and hopefully improve teacher perceptions and integrating tablets into the classroom.

Teacher One-to-One Telephone Interview Questions

Research Question 1: How do veteran teachers perceive the process of integrating tablets into the classroom?

Teacher Interview Questions

1. How have you integrated tablets into your lesson plans?
2. How do you perceive the process of integrating tablets into the classroom?

Research Question 2: What challenges do veteran teachers experience when integrating tablets into the classroom?

Teacher Interview Questions

1. How often do you use tablet technology in the classroom?
2. What are some of the challenges experienced by you when integrating tablets into the classroom?

Research Question 3: What opportunities have you observed while integrating tablets into the classroom?

Teacher Interview Questions

1. What opportunities have you seen developed from tablets in the classroom?
2. How do you collaborate with other teachers to integrate tablets? Please provide an example.

Zoom Interview Questions

Research Question 1: How do veteran middle and high school STEM teachers perceive the process of integrating tablets into the classroom?

1. Why do you believe all students can benefit from STEM instruction?
2. What strategies do you use to incorporate tablets into the classroom?

Research Question 2: What challenges do veteran middle and high school STEM teachers observe when integrating tablets into the classroom?

1. What barriers do you feel are most difficult to contend with during integrating tablets into the classroom?
2. What strategies do you use to overcome these barriers?

Research Question 3: What opportunities do veteran middle and high school STEM teachers observe when integrating tablets into the classroom offer?

1. How has integrating tablets in the classroom enhanced your teaching practices?
2. How often do you collaborate with other teachers to gain new knowledge about integrating tablets into the classroom?

Appendix B: Interview Guide

Interview Guide

Case Study: Perceptions of Veteran Teachers Integrating Tablets into the Classroom

Pre-Interview Questions:

I will begin this interview by introducing myself and asking that you do the same. Hi, my name is Joanie Rice, and I am conducting this interview as a research student at Walden University. Thank you for agreeing to be interviewed and explaining what this entails. There will be a 60-minute recorded interview transcribed and edited to include your words only. I will edit my questions. Your participation and all it involves will remain confidential.

This interview is for a qualitative case study that explores the perceptions of veteran middle and high school STEM teachers integrating tablets into the classroom. While interviewing you, I would like to focus on a technology lesson or project that indicates the challenges and possibilities of integrating tablets into the classroom. Please focus on a task you learned from that you could teach others. We will use this project as the focus of our interview. I would like to know what makes the integration of tablets rewarding and challenging for you. I want to see what you do as a veteran STEM teacher to promote technology integration in the classroom. Do you agree with using your experiences as a focus for our interview? Do you have any questions currently? Please, let us set up a time for the discussion.

Demographic Information:

- Approximately how often have you used technology in the classroom?
- Do you consider yourself a veteran teacher?

Teacher One-to-One Telephone Interview Questions

Research Question 1: How do veteran middle and high school teachers perceive the process of integrating tablets into the classroom?

Teacher Interview Questions

1. How have you integrated tablets into your lesson plans?
2. How do you perceive the process of integrating tablets into the classroom?

Research Question 2: What challenges do veteran middle and high school teachers experience when integrating tablets into the classroom?

Teacher Interview Questions

1. How often do you use tablet technology in the classroom?
2. What are some of the challenges experienced by you when integrating tablets into the classroom?

Research Question 3: What opportunities have you observed while integrating tablets into the classroom?

Teacher Interview Questions

1. What opportunities have you seen developed from tablets in the classroom?
2. How do you collaborate with other teachers to integrate tablets? Please provide an example.

Zoom Interview Questions

Research Question 1: How do veteran middle and high school STEM teachers perceive the process of integrating tablets into the classroom?

1. Why do you believe all students can benefit from STEM instruction?
2. What strategies do you use to incorporate tablets into the classroom?

Research Question 2: What challenges do veteran middle and high school STEM teachers observe when integrating tablets into the classroom?

1. What barriers do you feel are most difficult to contend with during integrating tablets into the classroom?
2. What strategies do you use to overcome these barriers?

Research Question 3: What opportunities do veteran middle and high school STEM teachers observe when integrating tablets into the classroom offer?

1. How has integrating tablets in the classroom enhanced your teaching practices?
2. How often do you collaborate with other teachers to gain new knowledge about integrating tablets into the classroom?

Reflections and Lessons

- What lessons or suggestions might you give other veteran teachers regarding integrating tablets into the classroom?
- If you had the opportunity to do the technology project or lesson you described to me repeatedly, what would you do differently and why?
- What skills did you use to integrate the tablets into the classroom?

- What do you think your students learned from the experience?

Closing

Our interview will end here unless you have something else you would like to share about integrating tablets into the classroom or teaching and learning experiences. Thank you! What a wonderful experience, you will receive a transcript of our interview for your review.