

21st Century Instruction: A Descriptive Case Study of a One-to-One Chromebook School

Jennifer Alcazar

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Jennifer Alcazar

Approved by:

Dissertation Chair: Melissa N. Ortega, PhD

Committee Member: Jeff Roach, EdD

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Abstract

Schools in the United States make significant investments in educational technology (ET) in an attempt to develop essential 21st century skills in students. The problem was a lack of understanding about whether the use of ET by teachers was effective in promoting innovative skills. A better understanding of the effective use of ET may maximize investments and promote the development of future ready skills. A gap exists in the communication of specific strategies that may be used to develop 21st century skills. The purpose of the study was to explore teacher perceptions of ET use in a one-to-one Chromebook program. Social Cognitive Theory provided the theoretical framework for the study. Key research questions explored teacher perceptions regarding ET use as well as perceived critical supports for successful instruction. Using a qualitative case study design, 16 teacher participants were surveyed, interviewed, and invited to submit lesson artifacts. Purposeful sampling was used to select teachers utilizing Chromebooks at least three times weekly in core content areas. Participant responses, surveys, and artifacts were coded using NVivo software, and thematic analysis was used to identify themes. Results indicated teachers developed 21st century skills in students through online collaboration, digital presentations, and research. Teachers also indicated a need for increased time to collaborate and access to on-site support providers. Study recommendations include the provision of increased time to teachers to build practical implementation knowledge and self-efficacy levels and the use of on-site technology support providers.

Keywords: educational technology, one-to-one devices, Chromebooks, 21st century skills

Dedication

This work is dedicated to the strongest women I know. Mom, your hard work and dedication inspired a love of learning in me from the first time you took me to the University of Washington bookstore. Thank you for a priceless example of how to work tirelessly toward a goal. Pilar and Izzy, your strength and grace inspire me daily to be the woman I know I should be. I am blessed beyond words by you and hope to reflect the lessons you have taught me about love and grit. And to Hector, the one who gave me these amazing young women: for the grace, love, and patience you have shown, I offer my respect and my deepest gratitude. Thank you.

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Chapter 1: Introduction

Across the globe, schools continue to invest in tools of technology in an attempt to ensure students are prepared for the rigors of an innovative 21st century future. Connectivity to the world wide web continues to climb; in 2017, more than 94% of school districts reported access to high-speed Internet for students (Mathewson, 2017). Educational technology (ET) spending rose sharply between the years 2016 and 2017, globally increasing \$2.2 billion from \$7.3 billion (Schaffhauser, 2018). As access to technology increases, teacher use of technologies also continues to rise. In 2017, 86% of teachers reported using technology ranging from social media to presentation software to laptops with their students on a daily basis (Cortez, 2017).

In recent years, conversation has shifted from if teachers should use technology with students to how best to leverage tools to meet learning targets and prepare students for a competitive 21st century future (United States Department of Education, 2017). McKnight et al. (2016) explained despite increasing access to technology, whether students leave school truly prepared for the rigors of the 21st century remains largely unknown. Levels of teacher self-efficacy, or personal belief in one's ability to successfully complete a task, have been demonstrated as a critical factor in whether teachers utilize technology effectively with their students (Delgado, 2018). Teachers possessing low levels of self-efficacy have typically avoided the use of technological tools, utilized them in a low-demand way, or used them to reinforce traditional methods of instruction. To increase self-efficacy levels and promote the use of innovative tools, Gürfidan and Koç (2016) identified the importance of extensive support systems for classroom teachers, including the presence of on-site mentors and coaches, professional learning opportunities, and strong site administrators who model and support the use of technology, providing time for training, staff collaboration, and practice.

Chapter 1 includes background for the study and a brief explanation of existing research related to teacher use of ET. A statement of the problem is provided as well as an explanation of the study's purpose. Findings may prove significant in advancing knowledge of how teachers may best be supported in using ET effectively, resulting in greater numbers of students leaving schools better prepared to meet the demands of an uncertain, competitive future. Three research questions driving the study are introduced, the study's conceptual framework is explored, and key terms utilized are defined. Finally, assumptions critical to the qualitative case study research are acknowledged and an explanation of the study's scope, delimitations, and limitations is provided.

Background of the Problem

Results from the 2018 administration of the National Assessment of Educational Progress (NAEP) Technology and Engineering Literacy Assessment revealed only 46% of students at the 8th grade level are at or above established proficiency levels, a gain of just two points since 2014 (National Center for Education Statistics, 2019a). As well, a significant, persistent gap in performance between White, Black, and Hispanic students was also revealed, with White students outpacing their Black and Hispanic peers by 31 and 24 points respectively in both 2014 and 2018 (National Center for Education Statistics, 2019b). Despite the continued investment of funds into ET for classrooms, such data reveal the presence alone of ET may not translate into technology proficiency gains for students. Recent research into teacher use of ET has focused on the importance of self-efficacy, the level and type of support provided to schools and classrooms, and the presence of strong principals capable of communicating a cohesive vision of ET use to support student learning goals. Self-efficacy, first described by Bandura (1977), is an individual's belief in their ability to complete a task successfully and is not necessarily

specifically related to actual skills possessed. Teacher self-efficacy levels have been shown to be directly correlated to classroom effectiveness, innovative practice, and willingness to expend extra effort to design experiences that meet the learning needs of all students (Bergil & Sariçoban, 2017; Zainal & Matore, 2021). Feng et al. (2019) argued self-efficacy levels are critical to the effective use of ET, as teachers with low levels of ET self-efficacy are significantly less likely to possess positive attitudes toward the use of ET despite increasing access to technology tools.

Understanding factors that influence self-efficacy levels is critical to promoting positive attitudes toward ET and the increased appropriate use of innovative tools. The provision of building level support systems, including professional development, has been extensively documented as critical to the success of ET initiatives in schools (Dinc, 2019; Hsu, 2016; Kilinc et al., 2018). The presence of external barriers, including restricted access to hardware, software, and the Internet, were commonly cited concerns by teachers, as well as a lack of administrative support for the use of ET (Kilinc et al., 2018). Dinc (2019) discovered additional barriers to the use of ET, including a lack of professional development and time for planning and implementation of new initiatives. Such external barriers, combined with internal barriers related to teacher attitudes about ET importance, usefulness, and ease of use were all found to affect self-efficacy levels and, in turn, implementation of ET (Durff & Carter, 2019; Tanas et al., 2020).

The presence of strong site leadership on ET integration has been extensively explored in the literature (Project Tomorrow & Blackboard, 2018; Thannimalai & Raman, 2018; Zainal & Matore, 2021). Even teachers with positive attitudes toward the use of ET perceived low levels of support and encouragement from site administration (Önalán & Kurt, 2020). Loughlin (2017)

documented the presence of resentment from teachers toward site administrators related to the perception that ET initiatives were largely imposed without the provision of time, training, rewards, or encouragement. In recent years, district-level leadership has recognized the importance of teacher attitudes toward the use of ET and has shifted focus from eliminating external barriers to building positive teacher and administrator attitudes in an attempt to increase innovative practice (Richardson & Sterrett, 2018). Despite extensive research on the importance of teacher self-efficacy, positive attitudes, and the provision of support for the implementation of ET initiatives, a gap in the literature remains related to the communication of specific strategies that are effective in promoting essential 21st century skill development in students (Hershkovitz & Arbelle, 2020; Sauers & McCloud, 2018). To date, recommendations from research has remained broad in scope and lacking specificity for site leaders and practitioners.

Statement of the Problem

The problem was a lack of understanding about whether the use of ET by teachers was effective in promoting essential 21st century skills. Background of the problem was while classrooms are increasingly being equipped with technology tools, it was unknown if such efforts positively impacted student essential 21st century skill acquisition as teachers often utilize such tools in a low-demand way, such as for word processing or administrative tasks (Delgado, 2018). In a survey of 57 secondary level mathematics teachers, Ardiç (2021) explored how technology was utilized with students. Forty-six teachers reported using Smart Boards to project traditional lecture notes for students, with only 14 reporting the use of additional tools beyond projection equipment. Vega and Robb (2019) discovered though teachers place high value on video creation tools for the development of essential 21st century skills, only 25% reported the use of such tools in classrooms, and only four of ten teachers reported professional development received on the

use of digital tools as “very” or “extremely” effective. Goldhaber et al. (2019) described teacher effectiveness as the most critical school-based impact on student achievement. Determining how teachers can best be supported to maximize personal self-efficacy and build innovative practice has the potential to significantly impact student achievement and 21st century skill building.

The importance of understanding how teacher attitudes impact the use of ET is critical to ensuring the success of 21st century learning initiatives. Tanas et al. (2020) explained teacher use of technology as dependent upon personal beliefs about ease of use and effectiveness for instruction. When teachers were not cognitively invested in ET, even in the absence of hands-on experience or evidence, usage was low, consistent with Bandura’s (1977) discovery that self-efficacy may not specifically be related to actual skillsets possessed. Site administrators possessing an awareness of how best to uncover and address negative attitudes surrounding ET, as well as how to best support staff in implementing innovative practice are more likely to observe improved attitudes and increased ET use.

Purpose of the Study

The purpose of the study was to explore teacher perceptions of ET use in a one-to-one Chromebook program. A study was necessary to determine if significant financial investments made in ET were being effectively leveraged to support student development of essential 21st century skills necessary for success in college, career, and beyond. Current research reveals teacher perceptions, attitudes, and self-efficacy levels may be impacted through the provision of support, including professional development and time for collaboration and implementation (Hall et al., 2019; Kilinc et al., 2018). Study findings may assist site and district leadership to discover additional supports needed to realize individual program goals, support teachers seeking

to develop innovative practice across the district, and inform the research community of effective, practicable instructional methodologies that prepare students for the 21st century.

A qualitative case study design was selected for the study as Yin (2014) described such methodology as effective for studying a phenomenon within a natural environment. Qualitative research seeks to investigate participant perception of the social world while focusing on theory generation (Baškarada, 2014). As participants of the study were asked to share personal perceptions of how students were being prepared for the 21st century in a one-to-one Chromebook environment, the use of a descriptive qualitative case study was appropriate. Sixteen teachers, all who instructed middle school students and utilized one-to-one Chromebooks in their classrooms at least three times per week, were asked to participate in the study via email invitation (see Appendix A). Study instrumentation included a Google questionnaire, semi-structured interview questions, video recordings, and instructional artifacts provided by participants. Interviews assisted with determining essential supports necessary for successful 21st century skill building, while provided artifacts revealed specific strategies and methodologies used by teachers engaged in innovative practice, thereby providing best practice and guidance for other teachers seeking to integrate ET into instruction.

Significance of the Study

Schools continue to make significant investments in technology to support the 21st century learning goals of students. On March 27, 2020, Congress allotted \$13.2 billion of relief funds to educational agencies to mitigate learning loss incurred from the COVID-19 pandemic (United States Department of Education, 2021a). A large portion of these funds was authorized to provide additional resources to schools to address individual needs, including the purchase of educational technology for students including hardware, software, and connectivity (Whiteboard

Advisors for TEC, 2020). As investments in ET continue to increase, school and district leaders should ensure provided funds are utilized efficiently and effectively. Claro et al. (2017) concluded most school administrators do not possess strong working knowledge of how best to support or promote innovative instruction with ET, despite recent calls for school leaders to move beyond management to instructional leadership and “digital evangelists” capable of inspiring 21st century pedagogies on their campuses (Project Tomorrow & Blackboard, 2018). Results obtained may assist school leaders in recognizing the critical importance of setting a vision for the effective use of ET to promote enduring, innovative instruction.

Classroom support providers also serve a critical role in ensuring innovative instruction occurs in schools. The provision of building level supports, including the presence of on-site technology support and mentors able to eliminate first-order barriers, has been identified as critical to the success of ET programs (Williams, 2017). Teachers experiencing frustration while attempting to access resources are more likely to possess lower levels of self-efficacy, reducing the likelihood of continued, effective use of ET (Delgado, 2018). Communication of specific supports identified by classroom teachers to support providers may assist with increasing self-efficacy levels and promote innovative 21st century instruction. Study results may lead to policy change about how ET support is leveraged as well as how leadership initiatives might inspire and support innovative practice, resulting in a greater number of students graduating with critical skills necessary for college, career, and beyond.

Research Questions

More than ever, schools are charged with preparing students for an uncertain future. Continued investments in educational technology promise positive progress toward students possessing valuable skills of the 21st century, however recent research reveals the presence of

ET does not always result in innovative instruction (Yerdelen-Damar et al., 2017). Often, teachers use ET in low-demand ways, serving to reinforce traditional teaching methods (Delgado, 2018). School and district leaders often lack the knowledge of how to specifically support classroom teachers committed to leveraging tools in an innovative way, contributing to the problem (Claro et al., 2017). Exploring teacher perspectives about specific instructional practices with Chromebooks that build essential 21st century skills in students may provide valuable information about how best to leverage ET to maximize student learning and preparation. The following research questions guided the qualitative case study:

Research Question 1: What were the perceptions of middle school teachers using Chromebooks to develop essential 21st century skills in students?

Research Question 2: How did middle school teachers in a one-to-one Chromebook environment believe students were being prepared for the rigor and competition of the 21st century?

Research Question 3: What supports were essential for middle school teachers in a one-to-one Chromebook environment seeking to prepare students for the rigor and competition of the 21st century?

Theoretical Framework

Bandura's (2008) Social Cognitive Theory (SCT) proposed individuals learn new skills through the observation and successful replication of the actions of others. An extension of social learning theory, SCT maintains people who observe the behaviors of those around them as well as the consequences of such behaviors use those memories to drive future actions, either copying behaviors or avoiding them. Behaviors resulting in rewards are more likely to be replicated than those resulting in punishments (Wulfert, 2018).

Bandura's groundbreaking Bobo doll experiments, conducted in 1961, served as the foundation for SCT (Hollis, 2019). Children witnessing the uncorrected physical aggression of adults toward an inflatable doll all replicated the aggressive actions. Bandura's Bobo doll experiments demonstrated the power of modeling in the acquisition of new behaviors. Social Cognitive Theory may reveal the power of both positive modeling and the use of rewards for teachers seeking to implement the innovative use of ET in their classrooms (Bandura, 2008).

Bandura further hypothesized new learning is not the result of random trial and error. Conversely, learning results from memories of past events, both positive and negative (Bandura, 1986). Teachers seeking to learn new, innovative strategies for classroom instruction utilizing ET are influenced by past experiences. When teachers experience negative impacts while using technology during lessons, including a lack of technical support, off-task behaviors from students, or a lack of personal self-efficacy, memories of such events may prevent future use. As well, observing the successes, failures, and struggles of peers or mentors may also have a significant impact on the likelihood of repeated use of ET, impacting willingness to take risks, experiment with new tools and technologies, and make gains in ET self-efficacy. Bandura's SCT may explain why teachers perceiving a lack of support from site and district administration are less likely to utilize innovative tools in a high-demand way. Based on the theoretical framework, school leaders and support providers may need to examine how existing structures, including support provisions, coaching models, and reward systems contribute to the success or failure of ET endeavors. A more thorough description of SCT is provided in Chapter 2.

Definitions of Terms

Depending on the context used, terms may have different meanings and interpretations. Developing a clear understanding of utilized terms helps to convey meaning and avoid misconceptions. Terms identified for use in the study are explained in the following list.

Educational Technology includes applications, devices, programs, materials, and environments designed to support access to educational opportunities for all users, regardless of demographic or location (United States Department of Education, 2017).

Essential 21st century skills are skills necessary for adaptation to complex social, economic, political, and technological change resulting from the rapid increase and spread of information (Karatas & Arpaci, 2021).

Innovative instruction is the provision of engaging learning environments that improve teaching and learning, facilitate comprehension, and increase interactions between diverse individuals (Ericksen, 2019).

Middle schools are institutions focused on best practices in responding to the developmental needs of young adolescents in Grades 6 through 8 as well as social identity development (Harrison & Bishop, 2021).

School administrators are individuals responsible for the instructional leadership of a school site and the development and management of school systems and policies (United States Department of Education, 2021b).

Self-efficacy is an individual's personal belief in their ability to perform a task successfully (Bandura, 1977).

Assumptions

Creswell (2014) explained the selection of a research approach and the specific methods employed during the data collection phase of a study are subject to researcher assumptions, or

items assumed to be true. Assumptions are influenced by a researcher's philosophical world view and should be examined and addressed to eliminate potential bias. Certain assumptions were required to conduct the study. Participant responses and contributions were assumed to be truthful, as no direct evaluative link existed between the researcher and the respondents at the time of the study, and no monetary incentives were offered for participation or performance. Due to the qualitative case study method selected, participants were aware the study was occurring, leading to an additional assumption that classroom activities and provided responses were altered from what might be expected during a blind study. Reassurances of participant confidentiality and the safeguarding of data were employed to promote complete, truthful responses.

Scope and Delimitations

The scope of the study included the perceptions of middle school teachers at a single, one-to-one Chromebook public school in a suburban Los Angeles County area. Use of one-to-one devices at the school began in 2012. Teachers from two neighboring middle schools in the same district were excluded from participation due to a lack of one-to-one device programs. Data were collected from teachers instructing students with ET in Grades 6 through 8 a minimum of three times per week.

Selection of a small cohort of participants served to increase the depth and complexity of case analysis, though resulted in less generalizability to the wider population (Tilton et al., 2017). Additional delimitations impacting generalizability included the use of participants from a single school site, thereby decreasing the likelihood of results applying to other schools in the district, those serving students in different grade levels, or those in different geographic locations. The selection of candidates claiming regular use of ET also served as a limiting factor, though was intentional by design due to the desire to address a gap in the literature related to the

communication of specific strategies used by teachers that impact essential 21st century skill building (Hershkovitz & Arbelle, 2020). As a result, study findings were not generalizable to teachers utilizing ET on a less frequent basis or at other grade levels.

Limitations

The use of a qualitative case study design presents inherent limitations, particularly related to reliability and validity (Yin, 2017). Reis (2009) described case studies as particularly useful for examining educational innovation and program evaluation. Further, case study has been identified as an effective means of investigating complex social units in a real-life context, resulting in potential significant advancement to the existing knowledge base of established phenomena. Conversely, case study designs have been criticized as being dependent upon the researcher as the primary instrument of data collection (Reis, 2009). Researchers may lack the time or funds necessary to dedicate themselves to rich, thick descriptions of phenomena. Further, Guba and Lincoln (1981) described the potential problem of researcher “ethics”, stressing unethical researchers might intentionally select discrete pieces of data to allow for virtually any conclusion. To address concerns related to study dependability, Yin (2017) recommended the use of data triangulation through utilization of multiple data sources and methods. The study utilized method triangulation by collecting data from questionnaires, interviews, and instructional artifacts.

Selection of a small number of participants from a single school had the potential to provide rich data to inform future practice. While generalizability was reduced, leadership at the school may use study findings to make significant policy changes resulting in enhanced acquisition of essential 21st century skills. The possibility for researcher bias presented an additional potential limitation to the case study research. As research questions were designed to

solicit participant perceptions of the use of Chromebooks for 21st century skill building, stimulate reflection on personal practice, and identify needed supports for the effective use of ET, meaning drawn from responses was subject to researcher interpretation and world view (Creswell, 2014). Examination of potential researcher bias, including the process of bracketing, or remaining objective about subjects and the research question, ensured results reflected solely the opinions and experiences of participants (Peters & Halcomb, 2015). Further, the use of subject matter experts to check the validity of questionnaire and interview items was an important step of the instrument development process that further reduced the potential for bias (Legaspi & Henwood, 2017).

Chapter Summary

Chapter 1 introduced the qualitative case study focused on middle school teacher perceptions of ET use in a one-to-one Chromebook environment. Potential benefits of the study were discussed, and a background of the problem provided. The problem statement, purpose, and significance of the study were presented, and three research questions guiding the data collection were introduced. Social Cognitive Theory (SCT) was described as the theoretical framework for the study. More detail about SCT is provided in Chapter 2. Key terms used in the study were defined, as were study assumptions, scope, delimitations, and limitations. Chapter 2 is a description of the process utilized to collect literature relevant to teacher use of ET to develop essential 21st century skills, the theoretical framework utilized, and the existing gap in the literature.

Chapter 2: Literature Review

In an effort to ensure students are prepared for an innovative 21st century future, schools continue to invest in various devices and tools of technology. Mathewson (2017) noted 94% of school districts had access to high-speed Internet. Eighty-six percent of educators reported using technology tools daily, including laptops, educational applications, and social media (Cortez, 2017). Despite increasing access to technology tools, it is not known if technology resources are preparing students for a 21st century future that demands innovation and global competitiveness (McKnight et al., 2016). The purpose of the study was to explore teacher perceptions of ET use in a one-to-one Chromebook program.

As access to technology devices continues to rise, the conversation has shifted from if technology should be used in the classroom to how such inclusion may best improve learning (United States Department of Education, 2017). The most current literature on the topic focuses on the importance of teacher self-efficacy, the provision of building-level supports for teachers, including professional development (PD), and the presence of a strong site leader. Delgado (2018) determined the level of teacher self-efficacy, or personal belief in one's ability to accomplish a goal, directly impacts how technology is used in the classroom and the quality of that instruction. Teachers with lower confidence levels typically used tools in a low-demand way, such as for center times or word processing, or not at all. Gürfidan and Koç (2016) identified support systems to teachers utilizing ET as the most significant indicator of successful ET integration. Support systems were defined as systems in place at schools that allow convenient access to technology tools, the provision of one-on-one support, instruction in the innovative use of ET, and the encouragement of professional collaboration and learning. Machado and Chung (2015) argued the role of the site principal in the implementation of

effective classroom practice is significant. As the site leader, the role encompassed both curriculum and technology; principals who modeled technology integration with their staff enjoyed greater success in integrating ET into classroom practice.

Although a large amount of research exists on the importance of providing teacher support for the integration of educational technology, a gap in the literature remains related to the communication of specific strategies that have a transformative effect on teaching and learning (Hershkovitz & Arbelle, 2020). Most recommendations for ET use remain focused on the instrumental use of tools that support existing teaching practices, pedagogies, and beliefs. Sauers and McCloud (2018) concluded limited research exists on the efficacy of ET or specific guidance for practical implementation. Recent recommendations remain broad in scope and fail to provide the specificity needed by site leaders charged with leading technology initiatives at their school sites.

This chapter addresses strategies used to locate relevant literature related to teacher use of ET and 21st century skill development. First, Bandura's Social Cognitive Theory (SCT) theoretical framework is introduced, and a discussion of how the theory supports the research is provided. Research on the role self-efficacy plays in teacher use of ET is examined, and the importance of building-level support systems for teachers including robust professional development is explored. Next, the significance of a strong site leader is discussed, and counterarguments against the use of ET for 21st century skill development are introduced. Finally, a gap in the literature is presented, and a chapter summary is provided.

Literature Search Strategy

Several databases were available through the ACE Library to locate literature relevant to the study. Retrieved sources included peer-reviewed journals and published dissertations. In

addition, 76.6% of the articles were published between 2017 and 2022 to ensure reviewed literature was relevant and current. Various government websites and professional organizations were also instrumental in informing the research. Primary databases searched included EBSCOhost, ERIC, Academic Search Complete, Open Dissertations, and Google Scholar. Searched terms included: *teacher self-efficacy*, *teacher technology use*, *21st century technology use*, *technology use and site leadership*, *technology use and teacher support*, and *21st century learning*.

Article reliability and credibility were stressed throughout the review of the literature process. Only credible sources were utilized, with emphasis placed on current, peer-reviewed work. A mixture of qualitative and quantitative studies was included. All literature was critically examined to ensure alignment with the study's purposes, and all sources were cited in the proper format.

Theoretical Framework

The theoretical framework for the study was Social Cognitive Theory (SCT), proposed by Bandura (2008). SCT, an extension of social learning theory, maintains people who observe the behavior of another, and the consequences of those behaviors remember observed events and use those memories to drive future actions. Bandura proposed people do not learn new behaviors solely through a trial-and-error method but rather by replicating the successful efforts of others. Whether or not the behavior of the model is replicated is dependent upon the immediate consequences that result. For example, behaviors resulting in favorable outcomes or rewards are more likely to be replicated than behaviors resulting in adverse effects or punishments (Wulfert, 2018).

Bandura conducted what became known as the Bobo doll experiments in 1961 to analyze children's behavior after an adult modeled physical aggression toward an inflatable doll by kicking and punching it with no consequence (Hollis, 2019). After witnessing the aggression, all the children replicated the adult's actions, demonstrating the value of modeling to acquire new behaviors. The experiments assisted Bandura in publishing a seminal article and book in 1977 where social learning theory and behavioral change were explained as dependent on self-efficacy, or an individual's personal belief in their ability to perform a task successfully (Bandura, 1977).

In 1986, Bandura published a second book that further refined the theory. Renamed social cognitive theory, Bandura more completely explained the role cognition plays in behavioral change (Bandura, 1986). Bandura argued human behavior is the result of personal, behavioral, and environmental factors and people learn through the observation of others. Whether observed behaviors are replicated is the direct result of individual factors (including levels of self-efficacy), behavioral responses received from others, and environmental factors present that influence the successful completion of a task (Bandura, 2008).

Social cognitive theory may predict how teachers in a technology-rich environment approach instruction with Chromebooks. If and how devices are used is likely determined by the individual teacher's level of self-efficacy with technology tools and observational learning that may have occurred in the past. For example, classroom teachers who have been exposed to regular modeling of innovative strategies by a peer, technology coach, or site leader may demonstrate more innovative use of technologies that directly influence student use and essential 21st century skills preparation. Conversely, teachers who have received little training or modeling may be less likely to attempt transformational instructional practices. Similarly,

teachers who have had negative past experiences with technology may be less open to using technology tools for instruction.

In addition to self-efficacy, studies have shown the level of support teachers receive with ET is a significant indicator of innovative technology use in the classroom. In alignment with Bandura's SCT, if teachers have experienced negative effects from a lack of technical support, they are less likely to attempt such instruction again. Gürfidan and Koç (2016) identified support systems to teachers utilizing ET as the most significant indicator of successful ET integration. Support systems were defined as systems in place at schools that allowed convenient access to technology tools, the provision of one-on-one support, instruction in the innovative use of ET, and the encouragement of professional collaboration and learning. Williams (2017) identified building-level supports as critical for the success of ET, though these supports varied widely by site.

A strong site leader has also been cited as critical to the success of ET initiatives on school campuses. In alignment with SCT (Bandura, 1986), site leaders who model innovative instruction may increase teachers' opportunities to build positive experiences with ET, thereby building positive memories and promoting future actions aligned with innovative practice. For example, Thannimalai and Raman (2018) discovered principals who consistently created a vision for staff integration of technology and provided ongoing professional development to teachers were most effective in influencing technology integration. Project Tomorrow and Blackboard (2018) reported similar findings regarding the importance of the site principal and called for a shift in the role of principals from traditional school administrators to leaders of technology and curriculum. Presumably, strong leaders who model innovative instruction and technology

provide additional opportunities for teachers to observe the successful use of ET and visualize favorable outcomes, thus replicating such activities more often, as Bandura (2008) described.

Research Literature Review

The literature review is a presentation of existing literature on the topic of the effective use of ET in schools, as well as arguments against its use. In addition, a review of previous studies that have examined factors supporting and hindering the innovative use of ET despite increasing access to technology tools is presented. Finally, a literature synthesis is provided to clarify what is known about the topic and discuss gaps in the literature and suggestions for future study.

Teacher Self-Efficacy

Bandura (1977) described self-efficacy as an individual's belief about completing a task successfully. As a result, self-efficacy is not explicitly related to the basic skills an individual possesses. The degree of effort put into tasks and the amount of perseverance present in the face of adversity are impacted by self-efficacy levels. Research into teacher self-efficacy has focused on specific domains or contexts, including how self-efficacy impacts computer usage. Computer self-efficacy (CSE) is defined as the extent to which an individual believes they can use computers and is strongly correlated with self-efficacy and support from site administration and peers (Dong et al., 2020).

The importance of teacher self-efficacy on classroom innovation, performance, and effectiveness is well documented. Zainal and Matore (2021) found both self-efficacy and strong site leadership significantly influence teachers' innovative behavior, including exploring opportunities, generating and promoting ideas, and realizing goals. However, high levels of self-efficacy had a higher effect on creative practice than transformational leadership. Bergil and

Sarıçoban (2017) similarly concluded teacher self-efficacy levels are directly correlated to classroom effectiveness. Teachers possessing elevated levels of self-efficacy were shown to be more effective in their teaching and more willing to expend extra effort to meet the learning needs of all students. As the need to prepare students for an uncertain future becomes more pronounced, teachers should be exposing students to innovative, technologically enhanced lessons (Morrison, 2019). Teacher self-efficacy levels have been shown to directly correlate to the ability and willingness to adopt enhanced pedagogies to meet the demands of the 21st century.

Self-efficacy as a predictor of future behavior has also been well established. Feng et al. (2019) argued self-efficacy is a multifaceted variable, making it context and task-specific. For example, teachers with high levels of self-efficacy related to classroom management may possess lower confidence levels using different strategies or tools. Teachers with low self-efficacy related to ET are less likely to integrate such tools effectively, despite access to technology resources. Yerdelen-Damar et al. (2017) asserted simple access to technology tools alone did not impact technological pedagogical content knowledge (TPACK) and the use of ET. However, significant relationships were seen between self-efficacy and TPACK and teacher attitudes and TPACK.

The Technology Acceptance Model (TAM), a theory first proposed by researcher Fred Davis in the 1980s, attempts to predict the likelihood of users adopting and accepting new technology systems (Dziak, 2020). Tanas et al. (2020) related TAM to teacher intentions and behaviors regarding technology, including personally held beliefs about the difficulty of use and usefulness of the tool to instruction. Technology use depended on user intentions and self-efficacy, even in the absence of hands-on experience. As well, cognitive investment in ET was

crucial to use (Tanas et al., 2020). When teachers believed tools of ET were not personally relevant, related to job requirements, or unclear in their usefulness, investment and intentions for use were low, consistent with Bandura's (1977) discovery that an individual's beliefs about phenomena are more critical than actual skillsets possessed.

Understanding determinants that affect self-efficacy is critical to supporting the development of solid attitudes and beliefs in using ET among teachers. Wood and Bandura (1989) explained both personal and organizational factors influence self-efficacy, including cognition, behavior, and the environment. As site leaders directly influence school environments, understanding leadership behaviors that promote the positive development of individual and collective teacher efficacy levels can profoundly impact instructional innovation and practice. Thornton et al. (2020) concluded school principals should systematically improve individual and collaborative teacher efficacy levels to impact student achievement positively.

Effective leadership practices are a key factor in high functioning schools, as principals can influence teacher beliefs about their abilities to meet expectations, including those related to the innovative use of ET (Thornton et al., 2020). Effective praise, modeling, constructive feedback, and positive relationship building all can increase self-efficacy among teachers. Bandura's (1977) argument that mastery of experiences is the most powerful influencer of self-efficacy enhancement is significant when considering how teachers approach the innovative use of ET. The provision of professional development that allows opportunities for guided and independent practice, feedback, and reflective conversation are all effective means of enhancing teacher self-efficacy (Thornton et al., 2020).

In addition to the presence of an effective site principal capable of positively affecting the environment, An et al. (2021) argued an additional six factors contribute to influencing teacher

self-efficacy. Years of service, disciplinary climate, relationships between teachers and students, job satisfaction, personal teaching practices, and social utility beliefs affect teachers' self-efficacy, with the strongest effects seen at the teacher level. Teachers with fewer years of experience possess more irregular effective teaching practices, making them less capable of dealing proficiently with issues and difficulties and negatively impacting self-efficacy. Ponnock et al. (2018) noted self-efficacy levels of early career teachers are lower than more experienced peers, though steady rises in teaching self-efficacy are common at this stage. As early career teachers make gains in student engagement and management, attrition declines, and confidence rises. Bandura's (1977) recommendation of modeling effective practices to increase self-efficacy should not be overlooked by site principals seeking to influence staff self-efficacy levels and innovative behavior practices. In addition to self-efficacy considerations, current research also stresses the importance of providing on-site support to teachers implementing ET in their classrooms.

Supports for Teachers Implementing Educational Technology

Multiple studies have examined the supports necessary for teachers implementing ET into instruction (Dinc, 2019; Hamutoglu & Basarmak, 2020; Tawfik et al., 2021). Considering existing barriers to the use of ET may assist site leaders in providing needed support to teachers seeking to implement innovative, 21st century pedagogies. For example, Tawfik et al. (2021) described two types of barriers to technology use for teachers: first-order or external obstacles and second-order or internal obstacles. First-order barriers include factors extrinsic to the classroom teacher, while intrinsic barriers include attitudes and beliefs about the use of technology during instruction. Kilinc et al. (2018) concluded the most identified barriers to using ET as described by teachers were external, including lack of access to technology hardware and

software, restricted access to Internet resources, and a lack of administrative and technical support. Notably, the researchers discovered significant differences in the responses of those teachers who had attended professional development focused on technology integration compared to colleagues who had failed to participate in such training.

Hamutoglu and Basarmak (2020) sought to determine the most common external barriers to effective ET identified by in-service teachers. Such barriers included a lack of vision for the use of ET, a lack of funding to support initiatives, a lack of professional development and training, and the lack of time to plan and implement ET initiatives. As well, inadequate facilities and infrastructures were cited as additional obstacles. Dinc (2019), while working with preservice teachers, identified similar barriers to the use of ET, including a lack of funding, equipment, and time to implement innovative techniques. The preservice group identified additional obstacles to technology use, including resistance from parents and security concerns. Finally, Hsu (2016) concluded even teachers with high self-efficacy and positive attitudes about technology use identified external barriers to instruction with ET, including a lack of student skill with technical tools, a lack of training, the lack of time to implement technology initiatives, and a general lack of technical support for teachers.

In addition to external barriers to the implementation of ET, internal barriers present challenges and opportunities for support. Internal barriers to the use of technology for innovative instruction are intrinsic to the classroom teacher and can negatively impact the integration of ET (Tawfik et al., 2021). Such barriers include teachers' attitudes about ET, how useful teachers perceive technology, and how comfortable teachers are with technological pedagogies. Factors determining whether technology is implemented into instruction include attitudes, social connections/culture, and pedagogical methods. Durff and Carter (2019) described attitudinal

barriers as beliefs held by teachers that are ingrained into personal belief systems. Attitudinal barriers included feelings teachers had about the usefulness of technology to their teaching (Durff & Carter, 2019; Tanas et al., 2020) and did not vary with age, gender, or technology experience (Teo & Zhou, 2016).

Tosuntaş et al. (2019) acknowledged the presence of external barriers to the integration of ET but described the most significant barriers as those directed toward teachers, including personally held knowledge, beliefs, and attitudes toward the use of ET. As a result, addressing and emphasizing teacher beliefs was recommended after eliminating external barriers to technology use. Loughlin (2017) similarly discovered both internal and external barriers, though discussed the emergence of a mismatch between teacher self-reported barriers and actual technical ability. For example, though teachers reported a personal lack of skill to effectively implement ET in their classrooms, results revealed technical knowledge far beyond the competencies required to implement ET. In addition, Loughlin (2017) described the presence of resentment connected with the perceived imposition of ET by leadership onto teachers and organizational failure to reward innovation in teaching and learning. Önalın and Kurt (2020) similarly found though teachers possessed adequate skills and high levels of self-confidence with integrating technology into instruction, many reported little encouragement to do so from leadership. In recent years, Richardson and Sterrett (2018) explained many district-level leaders have recognized such trends and have shifted the conversation surrounding ET implementation from overcoming external barriers to addressing second-order, internal obstacles, including teacher attitudes, to make positive gains in innovative teaching and learning.

Resistance to change has been demonstrated to have a significant negative effect on implementing technology in the classroom (Sánchez-Prieto et al., 2019). Analysis of data

revealed teacher attitude, particularly related to beliefs about ET usefulness, was the main predictor of instructional pedagogy and behavior. Dogan et al. (2021) examined if trends in teacher attitudes were consistent between elementary, middle, and high school teachers, discovering high school teachers possessed the lowest perception of the value of technology and hence the lowest levels of ET use. In contrast, elementary teachers had the most positive attitudes about ET, reporting the most frequent use of technology in the classroom, despite the lowest satisfaction levels with external support received from administration. Such findings are consistent with Bandura's (1977) assertion that self-efficacy, combined with past experiences, are significant contributors to behavior. Presumably, poor past experiences with successful technology integration may contribute to negative attitudes about ET, despite teacher awareness about expectations for use. Regular, ongoing, and customized professional development may assist teachers with overcoming past negative experiences with ET to promote increased use.

Professional Development for ET Implementation

Many studies have explored the necessity of providing robust professional development to teachers seeking to integrate technology into their instruction (Hall et al., 2019; Kazan & El Daou, 2016; Morrison, 2019). Though faculty may be encouraged to include ET in their classrooms, site leaders frequently fail to explain the subsequent educational benefits that arise for students, contributing to negative teacher attitudes about the usefulness of technology (Gaddis, 2020). Hyndman (2019) explained while teachers face pressure to become "digital experts," many do not have access to robust professional development designed to assist in becoming technologically proficient. In addition to lacking the appropriate skills to integrate ET effectively, not all teachers believe in the use of technology, particularly when technologies

disrupt the flow of learning through increased distraction, off-task student behaviors, and faulty hardware issues (Hyndman, 2019).

The importance of technology professional development for teachers has been well established. Teachers who participate in technology professional learning demonstrate improved perceptions, attitudes, and self-efficacy toward using ET (Hall et al., 2019; Kilinc et al., 2018). Presumably, through engagement with professional development opportunities, teachers experience positive interactions with innovative tools, building positive experiences and observations of others that powerfully impact attitudes and self-confidence levels, as Bandura's (1977) work suggested. As student one-to-one device programs continue to increase, some organizations have struggled to sustain them, having embarked on costly device initiatives without proper training for teachers or students (Borowiak & Davis, 2020). The possession of technology without associated professional development has been shown to produce minimal positive impacts on teacher self-efficacy levels, technology pedagogy knowledge, or consistent technology use (Yerdelen-Damar et al., 2017). In determining factors critical to the long-term success of innovative instruction for students, Morrison (2019) concluded content-driven professional development, a clear vision for the use of ET in classrooms, and the availability of site-based support providers is essential.

Approaches to ET professional development for teachers are wide and varied. Traditional training models have included workshops, education conferences, and seminars. However, the slow adoption of technology into classrooms suggests such methods have been incapable of meeting the ongoing needs of teachers seeking to implement technology into their instruction (Bostancioglu, 2018). Darling-Hammond et al. (2017) defined effective professional development as professional learning that changes teacher practice and results in improved

student outcomes. In addition, the researchers identified seven features of effective professional development for teachers, including content-focused, active, collaborative learning that includes opportunities for modeling and coaching, offers feedback and time for reflection, and is of sustained duration. Such professional development aligns with SCT, as teachers are provided with sustained opportunities to build new experiences and memories through positive observations of others, thereby increasing the probability of adopting new behaviors that integrate ET.

In recent years, teacher preferences for ET professional learning have shifted. Personalized professional development, online and face-to-face workshops, personal learning networks, teacher-led training, and the provision of in-class support were all reported as preferable and most likely to positively impact ET implementation by in-service teachers (Liao et al., 2017). Communities of practice, first defined by Wenger (1998), are comprised of groups of individuals who share standard practices and develop knowledge and expertise together through collaboration and social participation. Similar to Bandura's (1977) observations about individual learning that results from the observation of others, communities of practice among classroom teachers learning from one another are potentially powerful sources of professional development and support for educators seeking to develop new, innovative instructional approaches. As Online Communities of Practice (OCoP) become more common and potentially provide promising new means for robust learning, Bostancioglu (2018) cautioned levels of effectiveness are directly correlated with levels of participation and collaboration, stressing teachers should be encouraged to regularly engage with personally selected OCoP that appeal to specific areas of need. As a result, leaders attempting to increase the use of innovative technology on school campuses should be familiar with the potential Communities of Practice

and collaborative learning must positively influence teacher acceptance of ET and remain committed to the provision of time and support for teachers to engage in such professional development.

Li et al. (2019b) endeavored to determine if the professional development needs of ET novice teachers (“digital immigrants”) differed from the needs of ET experienced teachers (“digital natives”). The researchers compared ET use behaviors and implementation between both groups, discovering digital natives possessed greater comfort with technology tools and needed less instruction in basic operations training, though the group still required support and training to effectively integrate technology into instruction. Shanley et al. (2017) reached a similar conclusion after discovering teachers who claimed previous experience with tools of ET demonstrated lower levels of implementation than those without experience, possibly the result of struggling to integrate new systems of technology into existing classroom structures. As a result, professional development offerings should endeavor to consider the individual needs of all participants, avoid making assumptions about ability based on experience, and assist teachers with making meaningful connections between tools of technology and their curriculum. Teachers without previous experience with ET are often more successful in integrating new tools into classroom structures despite lower levels of initial investment, likely due to their lack of preconceived ideas concerning ET integration. Understanding all staff are likely to need support when integrating ET into instruction regardless of previous experience is critical when planning professional development programs for teachers.

Multiple studies have recommended professional development as an effective method for building the technical skills of classroom teachers (Bowman et al., 2020; Liao et al., 2017). Martin et al. (2020) concluded professional development significantly increased the skills of both

digital native and digital immigrant teachers, resulting in the effective transfer of explored content and tools into classroom environments. Increased familiarity with web 2.0 tools of technology was also observed when teachers participated in professional development sessions, including tools for improved collaboration, assessment, and student engagement (Sahin-Topalcengiz & Yildirim, 2020). Further, ongoing professional development that is differentiated to teacher needs and provided on demand has been described as most effective (Hall et al., 2019; Love et al., 2020). Such models of professional development have been recommended as part of professional learning communities (PLC) and Train the Trainer (TTT) initiatives.

Though the effect of professional development on teacher capacity is clear, addressing second-order barriers to ET integration, including teacher beliefs and attitudes, is vital to the effective integration of technology into classroom practice. Barbour et al. (2017) discovered though teachers possessed buy-in and interest in professional development, they were consistently more focused on their immediate teaching needs and functions. Bowman et al. (2020) concluded teacher values mediate professional development's influence on classroom practice, asserting professional development should target teacher values instead of simply addressing skill enhancements. Cheng et al. (2020) agreed that teacher expectancy and value beliefs are strong predictors of ET quality and quantity of ET integration.

Though recent research has clarified the importance of the relationship between teacher value beliefs and ET integration, few professional development models have focused on improving teacher attitudes and beliefs (Bowman et al., 2020). A notable exception may be found in Er and Kim's (2017) study focused on investigating how teacher memories can impact beliefs toward technology integration. The researchers utilized the Episode-Centered Belief Change (ECBC) model to explore memories teachers held related to the use of ET in their

classrooms, how these memories influenced their beliefs about ET, and how beliefs might be reconstructed through the exploration of persuasion activities. Er and Kim's (2017) innovative approach was found to change teacher-held beliefs about ET, a pivotal factor to be considered when designing professional learning programs. Furthermore, investigating teacher memories and the connection to subsequent attitudes about ET and self-efficacy levels directly supports Bandura's (1977) findings of the importance of past experiences, successes, and failures to future behaviors, including the integration of new practice into classroom pedagogies. Site leaders who possess an understanding of how attitudes influence ET use may promote professional development that targets teacher attitudes and beliefs to build new, positive experiences.

The Impact of Site Leadership on ET Integration

The effect of a robust and supportive site leader on the integration of ET has been extensively explored. Önalán and Kurt (2020) concluded though many teachers have positive views toward integrating technology into instruction, they perceive limited support from administration, both in removing first-order barriers to ET and administrative encouragement and rewards for its use. As expectations for the use and integration of technology evolve, a new class of school principals is emerging, those who serve both as instructional leaders and "digital evangelists" who set clear visions for the use of innovative, personalized instruction (Project Tomorrow & Blackboard, 2018). Despite the emergence of changing roles for site leaders, Claro et al. (2017) concluded most administrators possess only vague knowledge of how best to integrate ET into instruction, thereby contributing to the lack of support felt by teaching staff. Teachers and administrators also expressed conflicting perspectives about conditions necessary for the effective integration of ET and who should be held accountable for such integration. The

dissonance between teachers and site leaders may contribute to negative attitudes towards the use of ET, thereby stagnating future attempts to integrate technology into instruction successfully.

Site leadership understanding of the type and design of professional learning teachers prefer is crucial to staff buy-in and commitment to professional development initiatives. Many teachers have expressed interest in the use of site-based mentors and peer coaches (Love et al., 2020; Bennett & Broman, 2019; Ma et al., 2018), as well as the creation of professional learning communities that allow for the integration of social sharing and collaboration (Gürfidan & Koç, 2016). Failure to provide time to plan, practice, and implement ET initiatives has also been extensively expressed by teachers as a first-order barrier to integration that may be addressed by site leaders (Hamutoglu & Basarmak, 2020; Hsu, 2016). In addition to eliminating first-order barriers to ET integration, site leaders should remain cognizant of addressing teacher attitudes about ET, as beliefs about the usefulness of technology as well as the personal likelihood of success when utilizing digital tools have a significant impact on teacher TPACK levels (Cheng & Xie, 2018).

Veteran teachers have expressed the desire for personalized learning opportunities that are specific to individual needs, authentic and aligned with a clear purpose (Haggerty et al., 2019). The use of mentors and building-based teacher leaders may help provide personal support, personalized coaching, and distributed leadership in local classroom contexts (Bennett & Broman, 2019). Such models provide long-term access to support at the building level, allowing peers to work with one another, solve specific problems together, and improve practice. The use of a peer-coaching-based professional development model is significantly more effective on ET integration than an expert guidance approach (Ma et al., 2018). Peer-coaching models have been found to significantly impact instructional practice by allowing teachers the

opportunity to identify questions of practice, adapt instruction based on feedback from peers, reflect on work, and effectively transfer knowledge to teaching practice. Site leaders cognizant of Bandura's (1977) explanation that powerful learning stems from the observation and experiences of others may be motivated to develop peer-coaching and teacher leader models at their school sites.

Openly addressing second-order barriers to technology integration is an important consideration for site leaders. Continued focus solely on developing ET skills is unlikely to bring sustained change to teacher attitudes (Bowman et al., 2020). Teacher perceptions of site principal technology leadership are significant across the elementary, middle, and high school levels as leaders can influence social and organizational culture through vision setting and provided interventions (Wu et al., 2019). Confronting past teacher experiences, reconstructing beliefs through peer-coaching models, and allowing time for collaboration and reflection are all actions site leaders may engage with to address second-order barriers, change future behavior, and positively impact ET integration (Er & Kim, 2017). Site leaders should also remain committed to creating and sustaining a coherent vision for integrating technology on their campuses (Thannimalai & Raman, 2018).

As the pressure to equip students with the skills necessary for competition in the 21st century grows, site leaders face increasing challenges in preparing for their new roles as digital evangelists. Multiple studies have recommended increased technology professional development offerings for both pre-service and in-service administrators to increase self-efficacy levels (Hero, 2020; Raman et al., 2019). Research has concluded when site principal self-efficacy levels increase, levels of technology leadership rise in response (Dogan, 2018). In addition to ET proficiency, Gonzales (2020) concluded school administrators face significant challenges

budgeting for and sustaining technology initiatives and managing conflict from school staff not vested in such initiatives. As a result, site leaders should actively seek opportunities to develop personal technology leadership characteristics, conflict resolution strategies, and creative approaches to funding.

In addition to seeking professional development, successful school leaders should remain focused on promoting change and responding to successes and challenges. Understanding the change process, supporting risk-taking and innovation, developing a collective mindset of continual improvement, and remaining focused on instructional leadership and student-centered learning using technology have all been shown to be effective behaviors in promoting the innovative use of ET in schools (Pautz & Sadera, 2017). Webster (2017, p. 29) concurred, cautioning school leaders who possessed the perception they must “keep up with technology or be left behind” may adopt technology tools for the sake of doing so as opposed to aligning ET with educational goals, thereby leading to increased resistance from teachers.

Counterarguments

The National Education Association (2019) defined communication as one of four critical skills for success in the 21st century. Students should not only be able to analyze and process the overwhelming amount of information readily available in the modern world but also possess the ability to express themselves clearly, articulate opinions thoughtfully, and motivate others powerfully (National Education Association, 2019). Li et al. (2019a) compared the influence of technology on conversation patterns and teacher feedback in classrooms with both high and low levels of technology integration. Conversation analyses of teachers and students revealed increased levels of technology played a negative role in classroom discourse. Teachers utilizing higher levels of ET tended to display more directives through technical tools and engage less

often in spontaneous conversation and productive feedback. Li et al.'s (2019a) findings support the urgent need for professional development as critical support that models and guides teachers in leveraging digital tools for 21st century skill-building and success.

The effectiveness of technology for communication has also been challenged. Capelluti and McCafferty (2017) found 93% of site principals described face-to-face communication with stakeholders as far more effective than other technical means of communication, including email, social media posts, and text messages. Site leaders seeking to support teachers implementing ET into instruction should be mindful of the need to incorporate face-to-face models of collaboration for learning instead of simply providing lists of technological tools to teachers. When considering how technology impacted student learning during the COVID-19 pandemic, Hasnine et al. (2021) found many online technologies lacked the ability to support active learning, a superior instructional method utilizing role play, collaboration, and problem-solving more typically found in face-to-face classrooms. As a result, teachers employing technology tools should be exposed to observation, peer modeling, and professional development support that engages active learning strategies.

ET simply for the “sake of technology” has continued to be a visible trend in schools. Spector (2020) reported little progress made in the field of educational technology over the last 15 years, in large part to the tendency of schools to adopt each new technology as it emerges without careful thought and planning about how best to use such tools to improve teaching and learning. Ross (2020) observed similar trends and recommended leaders of ET conceptualize technology as a delivery system for content instead of a “treatment” for the classroom. The importance of pedagogy over technology as a vehicle for content delivery was also explained by Ehmann (2020), who asserted instructional design and the creation of experiences for students

that allow for the acquisition and application of new knowledge should be the goal of all learning activities, including those utilizing tools of ET.

The consequence of principal technology leadership on ET integration has also been well documented with mixed results. Raman et al. (2019) discovered high levels of principal technology leadership had little impact on teacher integration of ET in the schools studied. As a result, the researchers posited the principals included in the study might have overrated or underrated their technology leadership standards, supporting Claro et al.'s (2017) finding that many site leaders lack the understanding of how technology is best integrated into teaching and learning. Impacts stemming from technology leadership should continue to be examined, and the importance of professional development for both site leaders and teachers as a robust support system should continue to be offered, with attention paid to learning system design and implementation.

A Gap in Literature

A gap in the literature exists for specific, actionable strategies that teachers and leaders can employ to develop essential 21st century skills in students using ET (Hershkovitz & Arbelle, 2020). Researchers discovered though teacher attitudes toward the use of ET in classrooms were largely positive, strategies employed were shallow and tended to reinforce traditional modes of instruction and beliefs, as opposed to transformational models focused on developing essential 21st century skill sets. Sauers and McCloud (2018) concluded despite an increase in the popularity of one-to-one technology initiatives, limited evidence exists of the efficacy and practical implementation of such programs. The gap revealed both teachers and site leaders need practical, actionable strategies for integrating ET into instruction to transform teaching and learning. As Bandura's (1977) work suggests, the lack of specific, observable modeling of

transformative practices is unlikely to lead to a change in attitudes and behaviors, both by teachers and those who lead them.

Chapter Summary

Access to technology and the use of innovative tools is increasing in schools across the globe. Between the years 2013 and 2019, access to high-speed Internet for schools in the United States rose from 30% to 99%, in large part the result of the Federal Communication Commission's (FCC) E-rate program designed to provide discounts for web access to schools and libraries (Education Superhighway, 2019). Thanks to increased access to the Internet, approximately 65% of teachers reported using digital learning tools to teach every day, with around half (53%) communicating the desire to continue to increase the use of such technologies (Gallup, 2019). Teachers reported primarily utilizing tools of technology that provide data about student mastery and progress, provide opportunities for personalized, differentiated learning, engage students in education, and are easy to use. Despite increases in access and use, only 27% of teachers felt adequate information about the effectiveness of ET was readily available, substantiating a gap in the literature about practical implementation strategies that demonstrate how tools of ET can be effective in supporting learning goals as opposed to simply reinforcing traditional methods of instruction.

The effective use of ET in classrooms is dependent upon a variety of factors, including teacher self-efficacy, the provision of first- and second-order supports to schools, and the presence of a strong site leader with the ability to create a vision for innovative instruction. Delgado (2018) described teacher self-efficacy, or the personal belief in one's ability to complete a task, as a critical factor in the quantity and quality of innovative instruction that teachers provided to students. Teachers with low self-confidence levels tended to utilize ET tools in a

low-demand way or not at all. In addition, the provision of supports to teachers, including one-on-one support, professional development, and time for collaboration with peers, was identified as critical to the success of ET initiatives (Gürfidan & Koç, 2016). Machado and Chung (2015) discussed the importance of solid site principals who can set a vision for the use of ET in their schools and then support and encourage that vision.

Social Cognitive Theory (SCT), as proposed by Bandura (2008), maintains people observe the behaviors of others as well as the consequences of those behaviors to drive future behavior. Behaviors resulting in favorable outcomes or rewards are more likely to be replicated by others (Wulfert, 2018). Teachers attempting to integrate tools of ET into innovative instruction are likely to observe the behavior of peers. If positive outcomes for students are observed, teachers are more likely to attempt such changes in pedagogical practice themselves. Conversely, when negative changes result, the likelihood of replication is reduced. Past observations of others, as well as classroom experiences, both positive and negative, may significantly impact teacher attitudes, self-efficacy levels, and future ET implementation behaviors. Site leaders should be careful to provide opportunities for positive and effective modeling of ET strategies to teachers to address personally held beliefs and attitudes; such modeling can be provided by principals themselves, peers, and on-site coaches. Additionally, site leaders should be cognizant of the power of rewards in encouraging desired behavior. Giving praise and encouragement to teachers struggling to implement ET can be a powerful factor in encouraging ongoing use (Thornton et al., 2020).

In addition to self-efficacy, the level of teacher support provided while implementing ET tools is a significant indicator of innovative technology use. The most identified barriers to using ET as determined by teachers included a lack of access to technology hardware, restricted access

to Internet resources, and lack of administrative support (Kilinc et al., 2018). As described by Bandura's (2008) SCT, teachers experiencing negative impacts in the classroom as a result of the lack of technical support (inability to access the school network or desired websites, lack of support with students struggling to navigate hardware and software concerns, delays in lesson delivery and resultant student progress) are less likely to attempt such behaviors again in the future. Williams (2017) identified the provision of building-level supports to teachers as the most critical factor necessary for successful ET implementation, including providing access to ongoing training and professional development for all teachers.

In addition to external barriers encountered by teachers, internal barriers, such as personally held attitudes and beliefs about the ease and effectiveness of tools of ET have been extensively documented in the research and found to be a significant indicator of teacher intent to integrate tools of technology into classroom practice (Duff & Carter, 2019; Tanas et al., 2020; Tosuntaş et al., 2019; Teo & Zhou, 2016). As a result, after external barriers to the use of ET have been eliminated, professional development should directly address personally held beliefs and attitudes about technology and its usefulness, as a mismatch has been discovered between teacher self-reports of barriers and actual technical ability (Loughlin, 2017). Despite reporting low levels of knowledge and skill with ET, actual teacher competency levels were far higher than those reported, suggesting negative attitudes remain a significant barrier to future positive behaviors and implementation of ET.

Site leaders charged with transforming instruction in schools through digital learning tools should be aware of the influence of both internal and external barriers to the use of ET and actively work to eliminate such obstacles (Richardson & Sterrett, 2018). For example, Önalán and Kurt (2020) discovered many teachers, though possessing positive attitudes toward

technology, perceived limited support from administration in the use of ET, including little rewards and encouragement for using such tools. Possessing an understanding of how SCT affects teacher attitudes and behaviors regarding ET may help leaders design professional learning opportunities, engage in intentional reward systems for ET use, and provide time for positive peer collaboration and observation that build self-efficacy levels and ultimately positively influence teacher attitudes, beliefs, and behaviors.

Though most of the literature recommends using ET for innovative, 21st century instruction, questions about the effectiveness of such tools for student achievement remain. Teachers' attitudes toward the use of ET have been extensively identified as a significant internal barrier to the effective implementation of technology tools. Providing ET tools to classrooms without addressing personally held beliefs and attitudes about technology is unlikely to produce transformational change or innovative instruction. A gap in the literature exists for practical, actionable steps schools and leaders may take to ensure teacher attitudes about the usefulness of ET are addressed, thereby potentially positively impacting future behaviors and implementation. To determine how perceptions and classroom practices aligned, this study was necessary to investigate the perceptions of middle school teachers instructing in a one-to-one Chromebook environment. Findings may help site and district leaders design professional development offerings that target teacher attitudes and provide increasing support necessary for integrating ET into practical, innovative 21st century instruction necessary to prepare students for an uncertain future.

Chapter 3 is an explanation of the research design and rationale, the role of the researcher, and the research procedures utilized. Population and sample selection are discussed, as well as instrumentation, data collection, and data preparation. An explanation of data analysis

procedures is provided, as are considerations for reliability and validity. Chapter 3 concludes with a discussion of ethical procedures employed.

Chapter 3: Methodology

To ensure students are prepared for an innovative 21st century future, schools continue to invest in various devices and tools of technology. Global educational technology (ET) spending soared to \$9.5 billion in 2017, an increase of \$2.2 billion from 2016 (Schaffhauser, 2018). As the number of technological devices in classrooms continues to rise, the conversation has shifted from whether technology should be used to how it can improve learning and provide students with the skills needed for success in the 21st century (United States Department of Education, 2017). The purpose of the study was to explore teacher perceptions of ET use in a one-to-one Chromebook program. Three research questions guided the qualitative descriptive case study:

Research Question 1: What were the perceptions of middle school teachers using Chromebooks to develop essential 21st century skills in students?

Research Question 2: How did middle school teachers in a one-to-one Chromebook environment believe students were being prepared for the rigor and competition of the 21st century?

Research Question 3: What supports were essential for middle school teachers in a one-to-one Chromebook environment seeking to prepare students for the rigor and competition of the 21st century?

In the chapter, research design and rationale for the study are addressed, as are the role of the researcher and specific research procedures followed including identification and selection of the target population. Data collection instruments are discussed, data analysis procedures are described, and explanations of protocols utilized to establish the reliability and validity of data are provided. Finally, ethical procedures followed that ensured the protection of human subjects are detailed.

Research Design and Rationale

Creswell (2014) explained the selection of a research design is dependent upon the issue being addressed as well as the personal experiences of the researcher. Qualitative research methods utilize qualitative data such as open-ended survey questions, observations, interviews, and documents to understand social phenomena (Sawatsky et al., 2019). Yin (2014) included the qualitative case study design as a methodology effective for studying a phenomenon within the natural context or environment.

The purpose of the study was to explore teacher perceptions of ET use in a one-to-one Chromebook program. Qualitative research investigates participant understanding and interpretation of the social world with the aim of theory generation (Baškarada, 2014; Williams & Moser, 2019). Case study research, a type of design in qualitative research (Creswell, 2007), explores a bounded system over time using multiple data sources with the goal of combining evidence about the case and contextualizing findings (Campbell, 2015).

A qualitative descriptive case study approach was suitable because of the need to describe a phenomenon in a real-life context (Yin, 2014). Teachers using Chromebooks in a one-to-one environment have full access to technology tools, yet it remains unknown if devices are being leveraged to promote innovation or simply reinforce traditional methods of instruction (Campbell et al., 2015). Yin (2018) described case study research as an appropriate tool for describing the how and why of phenomena. As the research questions focused on asking what participant perceptions were as well as how students were being prepared for the rigor of the 21st century, the use of a qualitative descriptive case study was appropriate. Understanding that schools are social systems involving interactions between teachers and students further supported the use of a case study methodology, as Yin (2018) asserted such an approach may be used when

researchers desire to understand complex social phenomena. The advantage of employing a descriptive case study methodology was the potential for increased understanding of the complexity of the case (Creswell, 2007), as well as increased understanding of situations in context and meaning for participants, factors quantitative methodologies are unable to provide (Campbell, 2015).

Role of the Researcher

Campbell (2015) described the researcher as the primary instrument of data collection when conducting qualitative research. Case study researchers must spend extended time with participants in the natural setting, acting as listeners in the interview process and seeking to reduce researcher bias (Alpi & Evans, 2019; Campbell, 2015). Yin (2014) explained criticism may arise from a researcher's involvement in case studies because of the deep interaction necessary and the potential for unintended effects on reported results. Summative findings from case study research rely largely on assessments made by the researcher, who then becomes the maker of meaning (Creswell & Creswell, 2018).

Researcher action in the study was focused on observation, facilitation, data collection, and meaning making. The researcher was previously employed at the same school site as the participants and acted both as a teaching peer and supervisor during that time. There was no authority or power of evaluation with participants at the time of the study. No incentives were offered for participation. To control bias and safeguard data reliability, an online questionnaire was utilized to gather open-ended responses from participants. Following questionnaire completion, participants were interviewed to provide the opportunity for rich and detailed sharing of experiences and meaning making. Instructional artifacts were also collected from participants to allow for triangulation of data resulting in increased data credibility and the

collection of diverse views of the phenomenon being studied (Moon, 2019). The use of bracketing, or the identification of personal beliefs about the use of educational technology to develop 21st century skills, removed researcher assumptions and allowed for sustained focus on participant responses without the introduction of unintended bias.

Research Procedures

The following section is a description of the research procedures that were utilized for the study. Included is a discussion of the target population, sample selection, and the data collection instruments employed. Also included is a description of how data were collected and analyzed.

Population and Sample Selection

Forty-seven teachers were employed at the intended research site, each having full access to one-to-one Chromebooks. Sixteen teachers, all of whom instructed middle school aged students in Grades 6 through 8, were invited to participate in the study. Content areas taught by participants were mathematics, science, social studies, and English language arts. Heterogeneous purposeful sampling was employed to select participants possessing teaching experience with Chromebooks in various grade levels and content areas. Selected participants had the potential to provide rich information for an in-depth study of the phenomenon. According to Creswell (2007), the use of a heterogeneous sample allowed for the communication of diverse perspectives about the problem of study. Teachers who taught middle school and used Chromebooks at least three times per week for instruction were included in the study, while teachers who did not utilize Chromebooks at least three times per week were excluded from participation. Participants were invited to participate in the study via email invitation (see Appendix A). Ongoing communication with participants was also by email. After approval was obtained through the IRB and the school district, a Letter of Information (see Appendix B) and

Consent (see Appendix C) were forwarded to all participants as well as the IRB approval letter (see Appendix D), the district approval letter (see Appendix E), the anonymous Google questionnaire items (see Appendix F), and the semi-structured interview questions (see Appendix G). When participants convened for interviews, all material in the appendices was explained in detail, consent was obtained, and time was allowed to address any questions that arose.

Instrumentation

Instruments for the study included a Google questionnaire, a semi-structured interview protocol, and instructional artifacts. The questionnaire was researcher produced and utilized both multiple choice items to collect demographic data and open-ended questions to determine the perceptions of teachers developing essential 21st century skills in students in a one-to-one Chromebook environment, in alignment with Research Question 1. Items from the questionnaire sought to determine essential supports needed by teachers for successful instruction in a one-to-one Chromebook environment, in alignment with Research Question 3. Open-ended interview questions were designed to stimulate deeper thought by participants as well as elicit responses from participants about how teachers felt students were being prepared for the rigor and innovation of the 21st century, which aligned with all research questions. Questionnaire items (see Appendix F) as well as interview questions (see Appendix G) were validated by a team of five content experts, all of whom were credentialed educational technology coaches (see Appendix H).

Multiple researchers have stressed the importance of preparing students for a rapidly changing world through the development of essential 21st century skills (Rahman, 2019; Tharumaraj et al., 2018; Tican & Deniz, 2019). Skills necessary for success in the 21st century are vastly different from those utilized in the 20th century (Tican & Deniz, 2019), creating the

need for teachers to modify pedagogical strategies to remain relevant to learners' future needs (Tharumaraj et al., 2018). Teachers who provided instruction in a one-to-one Chromebook setting had access to necessary tools of technology, but it was largely unknown if access created a shift in teacher pedagogies. To determine teacher perceptions of essential 21st century skills preparation using Chromebooks, open ended questionnaire items and probing interview questions were created by modifying various items included on Ravitz's (2014) 21st Century Teaching and Learning survey. Ravitz's (2014) survey was developed for re-use by researchers interested in the study of 21st century teaching and learning, and included items related to eight essential 21st century skills: critical thinking, collaboration, communication, creativity/innovation, self-direction, making global connections, applying learning to make local connections, and using technology as a learning tool. Creation of a new questionnaire was necessary as the intended study sought to develop a rich and complex understanding of the experiences of teachers utilizing one-to-one Chromebook technology. While Ravitz's (2014) survey encompassed all eight areas, it was limited to Likert style items that did not allow for free response and deeper explanation by participants.

Questionnaire and interview items were divided into separate categories that aligned with the essential 21st century skills outlined by Ravitz (2014). Each category allowed participants to share if the identified skills were addressed in their classrooms and how. Participants were also asked to share any struggles or difficulties encountered while attempting to build essential 21st century skills in students.

The use of subject matter experts to check the validity of the questionnaire items as well as the interview questions was an important step of the instrument development process (Legaspi & Henwood, 2017). Ensuring instruments gathered targeted information was critical, as was

ensuring study respondents did not encounter difficulties or contradictions during the data collection process. Practicing credentialed educational technology coaches served as subject matter experts. Feedback from experts was used to modify and improve items as necessary.

Data Collection

Data collected for the study originated from three sources, including open-ended questionnaire responses, semi-structured interview protocol responses, and instructional artifacts provided by participants. After IRB approval was secured, study participants were sent an invitation to participate via email (see Appendix A). A consent to participate letter (see Appendix C) was included in the email as were the purpose and procedures of the research, any risks or benefits of participation, an explanation that study participation was voluntary and may be withdrawn at any time, and assurances of participants' right to confidentiality. After reviewing the letter, participants were invited to submit an electronic signature indicating understanding of the content and consent to participate.

After a digital signature was obtained, participants were presented with a link to an online Google questionnaire (see Appendix F) used to collect demographic information, as well as solicit initial thoughts and responses about how Chromebooks were being used in the classroom to cultivate essential 21st century skills in middle school students. Questionnaire items directly supported research questions 1, 2, and 3. Reminder emails about the study were utilized for the purpose of follow up and ensuring an appropriate number of questionnaire responses was received.

Completed questionnaires were used to select a random sample of 16 teachers to participate in semi-structured interviews. Zoom virtual meeting technology was utilized for the interviews to minimize interviewee inconvenience and travel time. After participant consent was

obtained, Zoom's recording feature was utilized to create interview recordings. All interview questions were asked in the same sequence for all participants to prevent the introduction of bias and ensure interview consistency. Initial interview questions were designed to build rapport with interviewees and create a level of comfort by demonstrating openness and curiosity about participant responses (McGrath et al., 2018). Conversational speech, active listening, and nonjudgmental behavior were employed to ensure ongoing participant comfort during interviews. Additional questions focused on obtaining deeper insight from participants by asking probing questions about how instruction with one-to-one Chromebooks specifically equipped students with essential 21st century skills. During each interview, video recordings were made, and notes were created. Participants were invited to discuss and submit artifacts of instruction designed to develop essential 21st century skills in middle school students for review and analysis. Such artifacts included lesson rubrics, assignment sheets, and lesson plans aimed at developing essential 21st century skills in students. Data collected did not reveal participant identity or physical characteristics, as anonymous participant codes were utilized. All questionnaire responses, video files, and interview notes were secured on a laptop computer protected with a password. Artifacts of instruction were stored in a locked filing cabinet in a locked office throughout the duration of the research project. After study completion, data will be retained for a minimum of 3 years and then destroyed.

Data Preparation

Questionnaire responses were downloaded to text and reviewed for inconsistencies, incomplete responses, or duplications. Video recordings were obtained as MP4 files, and using Zoom software transcribed into text documents, again for the purpose of better visualizing responses to detect errors, omissions, or duplications. Observation notes were scanned and stored

as PDF documents. Instructional artifacts were converted to Word or PDF documents. Within 48 hours of each interview, participants were invited to engage in member-checking of results through the receipt of an email containing transcribed interview and questionnaire responses. Corrections to responses were solicited and completed as required.

Data Analysis

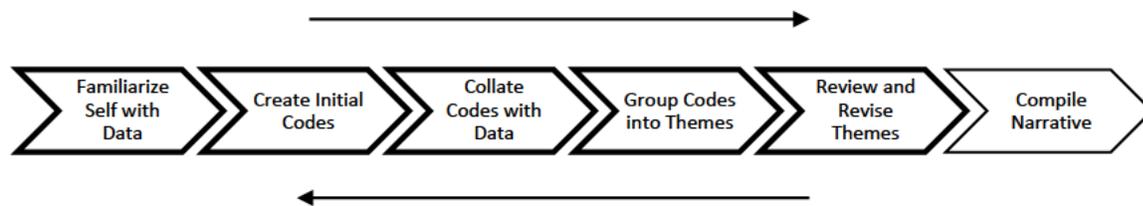
The purpose of the study was to explore teacher perceptions of ET use in a one-to-one Chromebook program. Yin (2014) deemed the qualitative case study approach as an effective means of studying a phenomenon in a natural context. Data collected from participants instructing students with one-to-one Chromebooks was examined and interpreted to develop knowledge and generate theory. Elliott (2018) described qualitative data analysis as the universal process of breaking down data to make something new. Descriptive data originated from three sources, including questionnaire responses, semi-structured interview transcripts, and instructional artifacts provided by participants.

Thematic analysis (TA), as described by Braun and Clarke (2014), was utilized to code collected datasets and then use the emergent codes to identify patterns across the data in response to the research questions. The process of TA involves six steps, as illustrated in Figure 1 (University of Auckland, n.d.). Though the process of TA is sequential with each phase building on the next, data analysis is recursive, moving back and forth between phases. The first phase of TA involved carefully reading all data while taking extensive notes to become familiar with collected content. After familiarization was complete, coding began. Williams and Moser (2019) described coding as a key organizing structure for qualitative data. A code is a word or short phrase assigned to a segment of data that attempts to capture the essence or provide a summative picture. After all datasets were coded, related codes were collated together and examined to

generate initial themes. Emergent themes were then reviewed and refined to determine the scope and focus of each and determine final themes for presentation and discussion.

Figure 1

The Process of Thematic Analysis



Initial code creation was utilized first to develop broad thematic domains. To accomplish the initial coding phase, questionnaire responses, semi-structured interview transcripts, and provided artifacts of instruction documents were imported to NVivo software after member-checking of data was complete. Using the software's manual coding ability, broad themes were identified in the responses and artifacts. Sections of text were labeled with coding tags to create child nodes in NVivo. Flick (2009) described the goal of coding as the expression of data in the form of broad concepts. As themes emerged, codes were developed with the goal of arranging data in a systematic way. The determination of codes for emergent data may often be more art than science (Williams & Moser, 2019). Initial examination of the data to determine initial codes followed Flick's (2009) recommendation of the use of *who*, *what*, *where*, *when*, *why*, and *how* questions to list codes and categories attached to text.

Following initial coding, codes were examined and collated to further refine, align, and connect themes (Williams & Moser, 2019). New codes were created as necessary. Child nodes previously created in NVivo were further sorted into larger parent nodes based on content similarities and relationships between the data. Demographic data were classified by creating participant node classifications that included gender, age range of participant, content area of

instruction, and years teaching. Participant node classifications were applied to each transcript/participant to further differentiate responses by gender, age, content area, and years of experience teaching. As thematic material was reviewed, line-by-line coding was employed to deeply engage with text, allowing for recognition of subtle nuances and connections between themes while surrendering bias (Williams & Moser, 2019).

Various NVivo data displays were utilized to communicate emergent themes in data and facilitate theory development. During the initial coding phase, a query command was utilized to create word clouds that displayed the frequency and type of words used by participants. NVivo's text search feature was used to generate word trees capable of illustrating words and ideas proposed by participants before and after a targeted word or theme was introduced. After codes were grouped into themes, NVivo's explore feature was used to generate project maps, concept maps, and charts. Andrade de Souza Neto et al. (2019) explained the use of qualitative data analysis software such as NVivo may add to the coherence of results as well as the confirmability and credibility of findings.

Reliability and Validity

Establishing the credibility of qualitative research is an important consideration to assure acceptance of research findings. Lincoln and Guba (1985) posited the worth of a research study is related to its trustworthiness and involves establishing credibility, transferability, dependability, and confirmability. Credibility, equivalent to internal validity in quantitative research, may be described as how believable the study is, and may be established using rich data sets, member checking, and triangulation (Korstjens & Moser, 2018). Enhancements to credibility of the proposed study were achieved by utilizing rich data sets resulting from the use of open-ended questions to probe for deep meaning from participants. Appropriateness of

questions to research objectives was confirmed using subject matter experts and peer review. Member-checking of questionnaire responses and interview transcripts was completed within 48 hours of submission, enabling study participants to make corrections to any errors or omissions in the data before analysis began. Further enhancements to study credibility resulted from the use of triangulation. Triangulation may be achieved by using different data sources, investigators, or methods of data collection (Korstjens & Moser, 2018). The study utilized method triangulation by collecting data from questionnaires, interviews, and instructional artifacts.

Transferability of research attempts to establish findings as applicable in other contexts. To achieve transferability, researchers rely on thick descriptions of the research process and included participants so assessments may be made if the process is applicable to other research contexts (Castleberry & Nolen, 2018). Utilizing a diverse group of participants strengthened study transferability, as the inclusion of multiple, varying perspectives possessed benefits greater than single perspective studies (Pratt & Yezierski, 2018). The study utilized thick and detailed descriptions of the research process and participants to achieve transferability. A diverse participant group was invited to participate, differing in age, gender, content area taught, and teaching experience. Utilizing a diverse population may make findings transferable to other contexts.

Dependability of research ensures study findings are consistent and replicable (Lincoln & Guba, 1985). Data should remain stable over time and under different conditions; the dependability of a study is increased when another researcher can easily follow the methodology used by the original researcher (Castleberry & Nolen, 2018). To establish dependability, an audit trail process was utilized to transparently document all steps taken during the research process from the development of the project to the publishing of findings (Korstjens & Moser, 2018).

The research project utilized careful record keeping and journaling throughout the process to illuminate all action taken and considerations made.

Confirmability of research may be described as the degree to which study findings are influenced by participants and not researcher bias or personal motivation (Lincoln & Guba, 1985). While Creswell and Creswell (2018) asserted the researcher is the maker of meaning, it is critical the perceptions and experiences of participants provide the framework and detail of collected data. To achieve confirmability, researchers may utilize triangulation to strengthen findings as well as employ reflexivity, a process whereby implicit biases, assumptions, and past experiences are confronted and scrutinized about how such assumptions might compromise study findings (Berger, 2015). The use of leading questions was avoided in both the questionnaire and interview phases to accomplish confirmability. Intentional care was taken to confront and eliminate researcher bias by avoiding the use of personal comment interjection and opinion. Instead, questions were designed to remain focused on participant thoughts and experiences. Follow up questions during the semi-structured interview phases were for the sole purpose of eliciting additional rich data and explanation from participants. Semi-structured interviews as described by Marshall and Rossman (1999) may assist in uncovering participant perspectives, facilitate immediate verbal clarification of what is being said, and assist participants with describing complex interactions.

Ethical Procedures

Human subjects participating in research in the United States are protected by the current system originating from the Belmont Report of 1979 (United States Department of Health, Education, and Welfare, 1979). The Belmont Report outlined critical considerations for those involved with research (Miracle, 2016). Safeguarding the rights of study participants from

unjustifiable exploitation by researchers is the primary purpose of the Belmont Report (Nicolaidis, 2016). All such research involving human subjects is presumed to include unique ethical considerations and is required to undergo ethical review by an institutional review board, or IRB (Coleman, 2019).

Gombert et al. (2016) explained ethical research studies must ensure participants meet specific considerations, including participation by choice and the possession of a clear understanding of the goals, procedures, and potential risks of study participation. The idea that research with human subjects should always benefit society in some way is firmly entrenched in current policy (Resnik, 2018); however, throughout the research process the rights of participants are always more important than study results. Various safeguards were included in the study to assure the protection of research participants.

An examination of potential researcher bias was conducted to ensure any such bias was detected and declared. Engaging in the process of bracketing, or remaining objective about subjects and the research question, ensures results reflect solely the opinions and experiences of participants (Peters & Halcomb, 2015). To further eliminate unwanted bias, the use of subject matter experts was employed to review all questionnaire and interview items. Though no revisions to questionnaire items were suggested by the subject matter experts (see Appendix H) review and commentary from experts was used to ensure intended questions were clear and concise and did not unintentionally guide or lead participants to desired responses that might skew results. While no conflict of interest or evaluative relationship existed with intended participants at the time of the study, care was taken to explain past relationships at the school site in the interest of transparency and for examination as a potential source of bias.

Obtaining informed consent is a critical part of any ethical research process. Ricketts et

al. (2019) explained informed consent as the process whereby participants give voluntary and informed permission about participation in research. Participants must also have the capacity to make such a decision. Successful communication can build trust between parties and enhance study objectives (Bergé, 2019). The study assured participants provided informed consent by providing a clear, written explanation of study aims and procedures as well as potential risks prior to the completion of any questionnaire items or interview. Digital participant signatures indicating understanding and consent to participate were required before access to the online questionnaire was granted. Explanation was provided to study participants to address most asked questions, such as how results might be used or how confidentiality was maintained. The rights of participants were explained again before participation in the interview process began, and the right to rescind participation at any time was stressed and explained both in writing and verbally before interviews commenced.

An additional important consideration for the protection of research subjects is the protection of participant confidentiality. Allen (2017) described confidentiality as an ethical practice that separates identifying information about participants from the data obtained. While demographic data was collected so that results may be attributed to categories of interest such as age or gender, the personal identity of participants was never revealed. The study protected participant confidentiality by removing identifiers from responses, instead assigning neutral pseudonyms. All participant documentation and responses were stored on a laptop computer protected with a password in a locked office for the duration of the project. In compliance with federal regulations, research data will be stored for a minimum of 3 years before being securely destroyed.

Chapter Summary

This chapter outlined the research methodology employed in the qualitative descriptive case study. The research design and rationale, role of the researcher, research procedures including sample selection and instrumentation, data collection and analysis techniques, and reliability and validity considerations were all discussed, as were ethical considerations for the protection of human subjects. Chapter 4 provides an overview of study findings.

Chapter 4: Research Findings and Data Analysis Results

To ensure students are equipped with 21st century skills needed for a competitive future, schools continue to invest in technological tools and devices. A shift from face-to-face learning to distance learning during the COVID-19 pandemic served to reinforce the need to develop digital skills in both students and teachers. Though teachers report increasing access to tools of technology, it remains unknown if technology resources are being used to develop 21st century skills of teaching and learning or simply reinforce traditional pedagogies (Delgado, 2018). Identifying specific strategies and practical uses for technology, providing time for professional development and peer collaboration, and ensuring immediate access to troubleshooting support may assist teachers with building self-efficacy and promote the innovative use of technology to develop 21st century skills. Understanding how social-cognitive theory (SCT) influences learning is also an important consideration for schools that endeavor to build systems of support for both teachers and students.

The problem was a lack of understanding about whether the use of ET by teachers was effective in promoting essential 21st century skills. The purpose of the study was to explore teacher perceptions of ET use in a one-to-one Chromebook program. Data were collected to assist with communicating practical strategies and tools teachers used to build essential 21st century skills in students, inform practice about necessary supports and barriers encountered, and provide data for further research into how SCT and teacher self-efficacy impact technology use and 21st century skill development. Three research questions guided the data collection process:

Research Question 1: What were the perceptions of middle school teachers using Chromebooks to develop essential 21st century skills in students?

Research Question 2: How did middle school teachers in a one-to-one Chromebook environment believe students were being prepared for the rigor and competition of the 21st century?

Research Question 3: What supports were essential for middle school teachers in a one-to-one Chromebook environment seeking to prepare students for the rigor and competition of the 21st century?

In chapter 4, the process of data collection is described, results and findings are summarized, research themes are presented with examples, and an explanation of how validity and reliability were maintained throughout the data collection process is explained.

Data Collection

Thirty-two participants were invited to engage in the study. Email communication was utilized to make initial contact with participants and included a description of the purpose and procedures of the research, any risks or benefits of participation, an explanation that study participation was voluntary and may be withdrawn at any time, and assurance of participants' right to confidentiality. A sample consent document was attached to the email. Candidates indicating interest in the research were provided an informed consent letter to sign, date, and return digitally (see Appendix C). All participants completed informed consent and were given the opportunity to ask questions before being provided a link to the online questionnaire or engaging in the interview process.

The qualitative descriptive case study design, as described in Chapter 3, utilized a purposeful sampling size of 16 participants. Purposive sampling criterion directly related to study goals and assisted with the identification of information-rich cases. Participants who met the following criterion were selected for study inclusion:

- Teach students in Grades 6 through 8.
- Utilize Chromebooks for instruction at least three times per week on average.
- Instruct students in mathematics, science, social studies, and/or English language arts.

Data from the online questionnaire were collected from 16 teachers in one school in the school district teaching Grades 6 through 8 in mathematics, science, social studies, and English language arts. All teachers had access to one-to-one Chromebooks daily. Mean teaching experience for participants was 16.6 years, with classroom experience ranging from 5 to 26 years. Mean years of experience using one-to-one Chromebooks for instruction was 8 years, with experience ranging from 4 to 12 years. Following questionnaire completion, all 16 participants chose to engage in the interview phase of the study. Study participants were a heterogeneous mixture of content area teachers with varied years of experience in the classroom, both with and without Chromebooks. Most of the participants were women working in the school under study. Table 1 provides a descriptive summary of study participants.

Table 1*Demographic Information of Study Participants*

Pseudonym	Gender	Years Teaching	Years with Chromebooks	Grade	Content area
Dominic	Male	12	8	6	Math, science
Evelyn	Female	16	10	8	Math, science
Pamela	Female	21	8	6	English language arts
Dolores	Female	20	4	6	Science
Hailey	Female	13	8	7	Social studies, English language arts
Matthew	Male	20	10	7	Science
Nora	Female	13	8	7	Math, science
Jacob	Male	5	5	8	English language arts
Ava	Female	21	5	7	Social studies
Ruby	Female	26	5	6, 7, 8	Math, English language arts
Katelyn	Female	10	9	6, 7, 8	Math, English language arts
Todd	Male	19	8	7, 8	Math
Leanne	Female	23	10	7, 8	Math
Katherine	Female	15	12	6	Math
Beverly	Female	13	6	6, 7, 8	Math, science, social studies, English language arts
Sandra	Female	24	12	6	Social studies, English language arts

The study was conducted in January of 2022, with data collection occurring over 25 days. Questionnaire data were collected via an online Google form, and interviews occurred during the time of the participants choosing via Zoom meeting technology. Eleven interview participants chose to participate during a preparation period at the school site, while five chose to participate outside of the instructional day in private homes. Table 2 depicts interview time durations. The mean interview time was approximately 42 minutes ($M = 41.9$).

Table 2

Duration of Participant Interviews

Interview	Minutes
Dominic	30
Evelyn	32
Pamela	35
Dolores	35
Hailey	35
Matthew	36
Nora	38
Jacob	39
Ava	40
Ruby	40
Katelyn	40
Todd	40
Leanne	45
Katherine	50
Beverly	59
Sandra	76

Note. Teachers were individually interviewed using Zoom technology. Interviews are ordered by duration (shortest to longest) as opposed to chronological occurrence.

Open-ended interview questions were created to determine the practices and perceptions of middle school teachers using Chromebooks to develop 21st century skills in students in Grades 6 through 8 as well as identify supports and barriers encountered during instruction (see Appendix F). Data collection was completed in 25 days, in contrast to an initial estimate of 2 months. Shortened timelines for data collection were likely due to the convenience and

efficiency of utilizing virtual interviews. All participants provided informed consent (see Appendix C) and gave explicit permission for recording and transcription of the interview process, which was completed using Zoom virtual meeting recording and transcription features. A reminder of the purpose of the study and the right to withdraw from the study at any time was provided at the start of each interview. All digitally signed consent forms (obtained using Adobe Sign document technology) were secured on a password protected laptop stored in a locked office. Participant pseudonyms were employed and protected to ensure confidentiality. Upon completion of the interview, Zoom recordings and transcriptions were stored on a password protected laptop and no physical copies were generated. No deviations from the proposed data collection were noted.

Qualitative research is critically dependent upon the credibility of data obtained. Member checking of participant responses provides the potential for the correction of erroneous information or the provision of supplemental detail and may contribute to study validity (Birt et al., 2016). Within 48 hours of interview completion, all interview participants were invited to member check personal questionnaire responses and audio transcripts. No participants provided corrections to recorded documents, though one participant provided additional commentary and a lesson sample after the member checking process.

After member checking, questionnaire and interview data were uploaded to NVivo on a password protected laptop. Thematic analysis (TA) was utilized to look for patterns of meaning in the data set. Braun and Clarke (2014) described TA as a robust, systematic framework for coding qualitative data, particularly when conducting applied research. While TA provides a sophisticated and thorough approach to data analysis, resultant findings are potentially more accessible to individuals not part of academic communities, including school leaders and

classroom teachers seeking to develop a functional understanding of how 21st century skills may be fostered in students. Data were assigned to four categories: questionnaire responses, interview transcripts, lesson artifacts, and case classifications. The use of case classifications provided the opportunity to visualize demographic participant data including participant gender, years of experience, age, and content area taught (La Trobe University, 2021). Using open coding techniques, initial codes based on the three research questions emerged from the data as questionnaires, transcripts, and lesson artifacts were analyzed. Notable, significant, surprising, or recurring themes and quotations were highlighted, marked, and assigned either to existing or new codes as necessary. Quotations from each code were analyzed to determine similarities, refine codes, establish themes, and make connections to research questions. Data collection procedures described in Chapter 3 were followed without deviation from approved protocols, though some participants chose to spend significantly more time providing rich detail about 21st century practices than anticipated, increasing interview times to longer than expected.

Data Analysis and Results

Sixteen participants completed an online questionnaire and participated in an individual virtual interview to answer six questions designed to elicit perceptions about how students in a one-to-one Chromebook middle school are being prepared for the rigors of the 21st century. True names of study participants were protected using pseudonyms to ensure participant confidentiality. Questionnaire responses and interview transcripts were member checked by participants immediately after conclusion of the interview process, and misspellings or omissions were edited.

After interview transcripts, questionnaire responses, and lesson plan artifacts were uploaded to NVivo, the open coding process began. Sections of text and lesson plans were

analyzed, line by line, and tagged with relevant open nodes. When meaning could not be captured with existing nodes, new nodes were created. Open coding resulted in the identification of 113 child nodes. Following open coding, axial coding was employed to refine, align, and connect the child nodes, resulting in 14 parent nodes. Parent nodes were demarcated into seven main themes, each theme arising from a minimum of 42% of total data sources (see Table 3). Appendix I illustrates how open child nodes were collapsed into parent nodes, resulting in emergent themes. The process of open and axial coding to generate themes was utilized to discover connections to each research question, and data were reviewed multiple times to ensure accurate assignment to color coded themes. Notable quotations supporting each theme were marked and documented. Procedures followed ensured the identification of themes explicitly relevant to the purpose of the research as well as the research questions. Data tables, corresponding narratives, and participant quotations are included for each theme's alignment to each relevant research question to provide context and support.

Table 3*Research Question Theme Alignment*

Research Question	Theme	Number of data files describing theme (<i>N</i> =66)	Number of coding references to theme	Number of participants discussing theme (<i>N</i> =16)
RQ1	Collaborative Construction and Presentation of Knowledge	46	134	16
RQ1	Skills of Research, Including Source Credibility	28	56	11
RQ2	Student Supports	40	241	16
RQ2	Extended Student Learning	35	134	16
RQ2	Student Engagement	35	106	15
RQ3	Teacher Supports Needed	31	192	16
RQ3	Barriers to Instruction	31	118	16

Findings for Research Question 1

Two themes emerged from Research Question 1: Collaborative construction and presentation of knowledge and skills of research, including source credibility. Research Question 1 endeavored to determine the perceptions of middle school teachers using one-to-one Chromebooks to develop 21st century skills in students. Participants were asked to describe specific ways they used Chromebooks in their classrooms to develop 21st century skills, including skills of critical thinking, collaboration and communication, creativity and innovation, self-direction, and local and global connection making. Additional skills developed through the use of Chromebooks were also discussed and documented. Interview, questionnaire, and lesson plan artifact data revealed emergent themes from consistent and notable responses from study

participants describing how students engaged in skill building activities and assignments with Chromebooks. Specific themes are reported in Table 4.

Table 4

21st Century Skill Development and Related Parent Nodes

Theme	Number of files describing theme (N=66)	Number of coding references to theme	Number of participants discussing theme (N=16)
Collaborative Construction and Presentation of Knowledge	46	134	16
Skills of Research, Including Source Credibility	28	56	11

Theme 1: Collaborative Construction and Presentation of Knowledge

Teachers seeking to develop 21st century skills in students specifically discussed building skills of presentation and the demonstration of learning in their students, citing the need for students to possess such skills in the future. Presentation media utilized by participants included collaborative Google Slide decks, Google documents, Padlet, Canva, Pixton, digital portfolios, and infographics. Ava expressed:

For some kids it's better for them to show their learning through imagery so you have that ability (...) certainly, it allows them to create and design. Google slides, for example, like the class was doing today, making Google slides and presenting as a group, I mean that's such an everyday work skill that you need to be able to do. It's so basic and it presents powerful visuals. You know, concise wording and then your verbal skills; your speaking needs to be the center of focus. It's not really about the slide, it's about you and how you're presenting it. Certainly, I just feel like we use it every day all the time. I don't know, it's just a part of everything that we do.

The ability for students to demonstrate knowledge using technology was a common theme, especially for struggling learners. Katelyn stated:

(...) Because of [the pandemic] I feel like they [veteran teachers] are more open to giving different ways to our students to share their knowledge. That is especially for our struggling learners (...) I think it's not a matter of teachers not wanting to, but now they understand it better and it's so helpful to our SPED [special education] kiddos.

Multiple participants discussed collaboration as an essential element of the demonstration and presentation of student knowledge, stating Chromebooks foster increased collaboration between students. Skills of collaboration and independence were noted by several participants, citing the use of various products in the Google for Education suite, including slides and documents. Ruby shared, "Sometimes I will use a Google slides presentation, and they [students] will all be on the same slide. Everyone has a different color they put their responses in so I can monitor and see (...) some sort of equitable participation." Ava explained Chromebooks afford students the opportunity to work with their peers from anywhere, stating "Students are given opportunities to work collaboratively on various assignments. They have created shared Google Slide decks, Jamboards, and Google docs. These platforms have allowed them to work collaboratively no matter their location." Pamela additionally shared how instruction with Chromebooks has encouraged student independence as never before, explaining "The kids are so self-driven, they just know where to find things themselves, they are just very resourceful. Because they have that Chromebook often, they don't even come to me because they know where to find the answer themselves." Katelyn discussed how students with special needs have specifically grown in skills of independence, self-direction, and demonstration of knowledge, sharing:

Students are also learning how to access Google calendar which is helpful ...they now know how to go on that forum and pull up what assignments they're doing and check their work. A lot of it is executive functioning skills, just them being independent, maintaining their organization, and getting things turned in on time. Those types of things are something I really work on heavily with them, because when they have those skills, it just trickles down to every other class that they have.

Theme 2: Skills of Research, Including Source Credibility

The use of Chromebooks to develop research skills in students, including the ability to determine the credibility of sources, was a second emergent theme. Jacob shared “I help them think about not everything online is true, I’m going to have to assert some critical thinking to make sure that I am actually backed up by facts and not just...opinions, as if that were the truth.” Some participants developed extensive lesson units to explore bias in the media, declaring the ability to explore source credibility as never before, due to nearly unlimited access to secondary sources. Evelyn explained:

I think that Chromebooks help develop critical thinking skills because we're not limited to our textbook. We have an infinite amount of information at our fingertips, so when we are presented with a hypothesis, researching whether or not something like that is true becomes very easy to do. There's information that's very accessible to us, which helps us develop critical thinking skills, because now we have different sources, where we can compare and contrast, and we can decide whether something sounds valid or invalid. If you were just left without the Chromebook and you were just limited to your textbook it's just one source of information, or you go to the library where you get maybe two or three resources to compare.

Sandra agreed, stating:

One of the downfalls of using these resources is the fact that there are so many it's a double-edged sword, so you do have to teach the kids how to read with a critical lens which, I think, is what we do with the Chromebooks. We have to teach them. Before I don't think it was as much of an issue whereas now I think in our world, it has become a huge issue and so kind of goes hand in hand.

Research Question 1 explored the perceptions of middle school teachers using Chromebooks to develop 21st century skills. A minimum of 69% of participants discussed the two themes described. Evidence for themes is provided in Table 4 and illustrated with quotations to provide direct context and support.

Findings for Research Question 2

Three themes emerged in response to Research Question 2: student supports, extended student learning, and student engagement. Themes and corresponding parent nodes from axial coding are reported in Table 5. Research Question 2 addressed how participants believe students are being prepared for the rigor and competition of the 21st century. Participants were asked to share and discuss artifacts of instruction with Chromebooks, including lesson plans, student work samples, or project handouts. 66 artifacts of instruction were provided for analysis.

Table 5*21st Century Preparation and Related Parent Nodes*

Themes and related parent nodes	Number of files describing theme (N=66)	Number of coding references to theme	Number of participants discussing theme (N=16)
Student Supports	40	241	16
<ul style="list-style-type: none"> • Ease of Communication <ul style="list-style-type: none"> • Feedback and Self-Correction • Differentiation 			
Extended Student Learning	35	134	16
<ul style="list-style-type: none"> • Alternate Sources • Making Connections 			
Student Engagement	35	106	15
<ul style="list-style-type: none"> • Virtual Experiences • Student Choice 			

Theme 3: Student Supports

When discussing student supports made possible through the use of Chromebooks, participants extensively referred to additional options for interventions for students absent from school or struggling to master content. Ease of communication between students and teachers, between students and peers, and between teachers and parents was frequently discussed. Several participants noted use of Chromebooks made anytime, anywhere communication possible for students. Pamela explained “I respond to my kids all day long (...) it pops up on your phone (...) so I’m checking all day long and I just feel communication between me and the students has just really improved.” Leanne, who recorded some of her lessons and posted them online, shared her students benefited from the use of Chromebooks when absent or forced to quarantine during the COVID-19 pandemic, stating “I would share the videos with the kids that needed it, you know for a refresher, or they missed part of it (if their Zoom went out), whenever I could, I would link

the lesson videos.” Ruby also shared how recording her lessons assisted with communication to her students, explaining:

I use the Google extension Loom and I just record it on a whiteboard, and they can see me actually working the problems, they can hear my voice. And it makes a better connection, I think, with students than seeing a video that I just find on YouTube. I found that it was so helpful for them...the kids seem to really like that, and it really resonates more with them than just sticking another video on.

In addition to teacher-to-student communication, participants extensively commented on how Chromebooks facilitated communication between students, particularly for reluctant students who are typically slow to participate or provide feedback to peers. Beverly referred to a particular student in her classroom as “very shy and quiet but give her the ability to communicate on a Chromebook and she goes off!” Sandra, in describing the culture of the community in which she serves, explained:

So many of our students, in particular, because of their culture, experience a lot of anxiety and now that I’m (...) learning about being a culturally responsive classroom, I know why this [online communication] is so good, because it is culturally responsive. Because in our Asian community, it is definitely part of the culture to be a listener in the classroom and not being as much of a participant in education, and so I feel like digital technology allows us to give them an avenue to have a voice in a safe way.

Feedback and self-correction were also described frequently by participants and are easily facilitated using Chromebooks. Pamela shared the commenting feature in Google documents allows for nearly instant, real-time feedback to students, explaining:

The immediate feedback that they get is just so valuable. I'm just thinking back to the day when we used to collect paper and they'd have to wait for me to comment and pass it back. I mean just the process of writing is just so sped up and I just feel like I've been able to do so much more in a school year than ever before.

When describing the online math program students use on their Chromebooks, Evelyn stated “They are just continually practicing and getting immediate feedback, and it levels them to wherever whatever level they are at, on the questions they answer.” Hilda identified the use of Google forms in the provision of peer feedback, stating “We usually give feedback through Google forms, and then we print out the results without names...students can reflect back and...modify their designs based on that.”

Differentiation of content with Chromebooks presented another common theme in the data. Beverly shared her students interact with content on Chromebooks that is specifically targeted to their ability level, though her direct classroom instruction is usually directed at the median level student. Reflecting on differentiation, Beverly shared “Even though I do a whole group lesson, I kind of teach at the middle ground level, [using Chromebooks] they might re-read what we read at a lower level or repeat it at a higher level.”

Theme 4: Extended Student Learning

The extension of student learning while using Chromebooks emerged as a second theme. The availability of alternate sources beyond the textbook was noted by several participants, including Todd, who shared his geometry textbook does not adequately allow students to visualize charts and graphs. Instead, Todd explained “We graph using Desmos, and then GeoGebra has different activities that we can do to ‘see’ geometry (...) to make concepts more visual (...) like how the exterior angles of a polygon add up to 360.” Content from alternate

sources also presented opportunities for students to review course material on their own, whether based on a need to review content due to absence or misunderstanding. Nora explained the use of EdPuzzle, which embeds formative assessment questions into a video, allowing students to “go at their own pace (...) at their own speed. They can rewatch things if they miss something, they can answer questions and it tells them right away (...) how they did.”

In addition to having access to additional source material, participants regularly explained how Chromebooks enable students to make connections to the real world. Katherine described the use of common websites, including real estate sites and car retailers, to assist students with making budget analyses. Katherine explained “They love searching the Web (...), you give them a spark of that and they went wild, they went to New York and different states, so I just say, okay (...) you are making it tangible and fun, you have buy-in already.” Ruby agreed, sharing a recent story about her students who had heard about a tsunami warning on the news. Upon being asked by students if they could research tsunamis, Ruby shared:

I think I give my kids a lot of choice in what we are working on, and they make those connections with things that are happening in the community or around the world. They might look at different news or current events...because they are pretty savvy these days with social media and the news. They come in, they have these interests (...) they wanted to know about tsunamis, because there was a tsunami warning. I was able to jump off into okay, let’s think about it (...) it’s kind of my way of letting them see that. You know their interests are really important (...) and connecting them to the outside world, they’re not just in an isolated space.

Theme 5: Student Engagement

Student engagement through the provision of virtual experiences and choice was revealed as a third emergent theme. Multiple participants discussed virtual experiences as a particularly engaging use of Chromebooks with students and reflected upon the impact the COVID-19 pandemic had on the use of virtual experiences. Hilda, an English language arts and social studies teacher, shared the regular use of Google Earth to transport her students to places being studied, stating “It’s just (...) fun to see a real world, where it is today and what it looks like compared to the Middle Ages...learning about that just kind of opens up another aspect we can use that we didn’t have before.” Katelyn shared similar thoughts, explaining how Chromebooks help students recognize what is beyond the walls of their classroom:

My kids connected with a school in Africa (...) for about 2 years, we were able to actually do video chats and things like that with a school in Kenya. Just being able to reach out, for those kids to be able to know and eventually see that they’re talking to these people in another country (...) because of technology, they were able to do that, to open and broaden their whole vision. You’re not just stuck to the people in your classroom, or the people at your school, or even the people in your city, you have the ability to reach out and touch and work with people all over the world. That was a really cool experience for them (...) they were able to learn about other students and their way of living, their education or lack thereof. It was a really, really cool experience for them to kind of get that knowledge, a lot of kids never even thought about what students go through in other countries (...), they would send pictures to us, we’d send pictures to them, but obviously they didn’t have Internet access all the time, when we got to video chat they literally had to be bused to a little dirt floor cafe that happened to have Internet. [My students] were floored, ‘wow, this is real, we’re so fortunate to have what we have here’ and it just really

made them value their schooling here. But again, that's all due to technology being able to have that type of access at your fingertips.

In addition to virtual experiences, multiple participants cited the ability of Chromebooks to provide students with choice as a strong engagement tool. Dolores shared:

I use choice for a lot of different assignments. For me it, it gives students an avenue for the creativity of they how they want to do it a final product and show me what they know, and I really don't mind however you do that (...). Not all teachers will or are comfortable using choice. They want to dictate everything and have a specific format when they're going to grade.

Ava agreed Chromebooks facilitate high levels of student choice, stating “I can offer to them multiple digital resources and give them the freedom to pick and choose what interests them beyond the little blurb that's in a textbook, I think it gives an opportunity for students to go in depth.”

Research Question 2 explored how teachers believed students are being prepared for the rigor and competition of the 21st century through the discussion of specific learning activities and lessons. All participants extensively discussed themes three and four, 94% discussed theme five. A minimum of 53% of all data sources supported the themes, as documented in Table 5. Associated participant quotations are provided for additional supporting evidence of themes.

Findings for Research Question 3

Two themes emerged during exploration of Research Question 3: essential teacher supports and barriers to instruction. Research Question 3 addressed supports teachers using Chromebooks to develop 21st century skills in students who felt were essential for success.

Interruptions or distractors impacting success were also identified and documented. Themes and corresponding parent nodes from axial coding are reported in Table 6.

Table 6

Essential Teacher Supports and Related Parent Nodes

Themes and related parent nodes	Number of files describing theme (N=66)	Number of coding references to theme	Number of participants discussing theme (N=16)
Essential Teacher Supports:	44	148	16
• Training/Professional Development			
• Time Considerations			
Barriers to Instruction:	48	116	16
• Hardware Concerns			
• Management and Monitoring			

Theme 6: Essential Teacher Supports

Participants openly shared thoughts about essential supports necessary to effectively utilize Chromebooks in a one-to-one setting. Participant mean years of teaching experience was 16.6, while mean years instructing with one-to-one Chromebooks was 8. As a result, most participants considered themselves veteran educators, and openly shared early adoption struggles, though acknowledged a vast improvement in support over the last 10 years. Sandra, the most veteran one-to-one educator at 12 years, stated:

It's interesting, because when we started, we were ahead of the curve, so we were addressing all of the issues with tech support. I mean now you're not going to have the dropping Wi-Fi issues that we constantly had. You're not going to have this net nanny thing, because now, if a school district is going to adopt one-to-one, they're going to adopt GoGuardian, they're already going to have a network that's going to hold

everybody's amount of data that they need, so you know, adopting now it's going to be so much easier than what we experienced.

Despite acknowledging improvements to support provided to teachers in a one-to-one environment, study participants noted the need for ongoing training, professional development, and time with peers. Nearly all participants shared the need for teachers utilizing Chromebooks to possess a basic knowledge of Google products. Ava shared “The new Google training is really good. It gives a good breadth of knowledge and practice so that you feel like you are comfortable.” Evelyn agreed stating “definitely a teacher would have to be proficient in using Google Classroom and Google Drive.” Nora added “I feel like a lot of them [teachers] are comfortable now, but if they are not comfortable with things like the Google platforms, training is helpful (...), the basics, is a good starting point for people who are brand new.”

Teacher risk and the need for practical, hands-on understanding of how to apply technology in the classroom was noted by several participants. Beverly stated “I think at first technology scared me because I’m not the most tech savvy person. But seeing the way the world is going and how much more technology can open the doors to accessing learning I have conformed a lot and I’m really proud of myself.” When sharing about her level of technology proficiency and why she struggles to integrate technology sometimes, Leanne explained “I don’t know enough, and I am a very linear thinker. I have to get through my book and these standards, I need to have these kids ready for the state test, I don’t want to get off track with these things.”

The desire for dedicated time with peers who have found success with effectively implementing technology into their instruction was shared by many participants. Jacob, when explaining support that must be in place at the start of a one-to-one program, stated:

You need dedicated time to go over the uses of technology and how it can be helpful, not just on a theoretical level. You've got to show them [teachers] here's how you can use it today in class. Because some teachers are very hesitant about taking a chance on technology.

Dolores spoke of increasing the practical knowledge of teachers using technology, stating "I am not super creative, so when I want to do something, I look it up first because I know somebody else has made a plan. Having the knowledge to be able to incorporate [technology] into lessons would be very helpful." Evelyn echoed the sentiment, stating the need to understand how to "incorporate technology into the classroom, how you can use the technology to track the motion of gravity, just a proficiency with it."

Study participants additionally shared the successful integration of technology into lessons takes time, particularly in the beginning. Dominic explained "Teachers are so busy, I think it's hard to find time to learn, and also it's kind of scary to try something new, because you don't know if it will work or not." Leanne, reflecting on learning technology in the beginning, shared "At the beginning my head was exploding, it was such a sharp learning curve, it was hard." While discussing how he might modify existing lessons to make them technologically friendly, Dominic shared "The lesson hasn't landed in my lap, and I'm like, do I really have the time to go in and rework this and figure out a way to do it on the computer?" Hilda shared the proper use of technology can be both a timesaver and a burden, stating:

Time is a barrier, and you save time, like we have been talking about this whole time. But it also takes time initially to learn programs and understand them. Once you do know them and understand them, it doesn't take as much time but there is also time in the

classroom where you have to get the Chromebooks out and make sure they are all working and charged, and then take time at the end of class to put them back correctly.

Theme 7: Barriers to Instruction

Barriers to instruction emerged as a second theme from the data, including hardware considerations and classroom management of technology. Multiple study participants discussed how the age and quantity of hardware can be a barrier to instruction, including Todd, who explained Chromebooks can be limiting, “especially as they age, they get slower and slower.” Ruby, while discussing barriers to instruction, shared:

So, there's a lot of barriers, one of the things is the Chromebooks are not very new and so there's a lot of hardware issues. They're not always working properly or they're super slow and so that can be a huge barrier. Also, because they're older they don't have some of the assistive technology pieces that would be helpful for some of my kids, like the touch screens and things like that.

In addition to aging hardware, slow or dropping wireless capability was cited by many participants as a major barrier to instruction. Evelyn discussed how dropped wireless can “cripple you during the day if you’ve become dependent on Chromebooks. You learn after a while how to get around it, but especially in the beginning when you’re learning to use Chromebooks it is highly inconvenient.” Hilda stated, “Sometimes our internet will go out and (...) we had this great lesson, but now we have to be on our textbooks.” Sandra agreed, explaining “I can't tell you how many times I was so frustrated because I'd spend so much time putting together a lesson and the Wi-Fi wouldn't work.”

Classroom management and monitoring of Chromebooks was a second significant barrier discussed by study participants. Student distractibility and the need to ensure students remained

on task throughout lessons was a common frustration for teachers. Ava shared Chromebooks “can give the kids too much freedom” and can “feed into their impulsivity.” Nora discussed how students become easily distracted “on the wrong sites”, requiring increased management from the teacher. Katelyn, while discussing burdens to instruction, stated:

I think the most obvious is that because they have access to so many different things that it leaves it the door open to be like, you are not looking at me right now, let me pull up this game (...). They recently disabled a lot of the Google extensions, because we were having a lot of kids go on things that are just not what you need to be doing at school, kind of distracting extensions. So that's definitely one of the challenges, however, with having stuff like GoGuardian, I can see what they're doing.

Multiple study participants discussed monitoring software such as GoGuardian as essential, though some expressed frustration with the lack of implementation training and chose to use physical proximity to monitor on task behavior. Katherine shared “I am always walking around” while students are engaged with Chromebooks and changed the physical layout of her desk in her classroom to “the back of the room, because I want to see all of their Chromebook screens.” Ava shared students on Chromebooks can open various sites, but “I don’t GoGuardian them, that’s not how I spend my energy. I just give physical presence, it can lead to off-task behavior, but for the most part once you catch it, it pretty much dissipates.” Nora discussed utilizing character development lessons in ensuring students remain on task, stating “one thing we always talk about is integrity, you know we're always talking about having integrity and making sure we're on the right website, that we're not getting distracted.”

Research Question 3 sought to identify supports teachers using Chromebooks to develop 21st century skills in students felt were essential for success. Table 5 documents the percentage

of data sources supporting themes six and seven; 67% of collected data sources included detail about teacher training and the provision of time for training and teacher collaboration, while 73% included significant barriers to instruction including hardware concerns and classroom management issues. Quotations from diverse participants further supported emergent themes.

Reliability and Validity

Credibility, the equivalent of internal validity in quantitative research, is the measure of how much the findings of a study may be trusted (Korstjens & Moser, 2018). Accepted means of establishing credibility were utilized in the study, including the use of rich data sets, prolonged engagement with participants, triangulation, and member checking. Study design provided multiple opportunities for participants to provide rich detail into experiences, including the use of open-ended questionnaire items to probe for meaning and extended interview times averaging 42 minutes. Content experts and peer review were utilized to ensure appropriateness of research questions to study objectives, and member checking of questionnaire responses and interview transcripts was completed within 48 hours of participation, providing study participants the opportunity to correct any omissions or errors in data sets before data analysis commenced. Further enhancement to credibility was provided using triangulation, as data sources included questionnaire responses, interview transcripts, and instructional artifacts.

Hennick and Kaiser (2021) described saturation as a core principle in qualitative research, frequently used to determine when sufficient data has been collected to ensure validity and robust understanding of the phenomenon under study. Data saturation was obtained after the 13th participant was interviewed as no new codes emerged from subsequent interviews. According to Saunders et al. (2018), when saturation is reached criterion for discontinuing data

collection is met, as further sampling is unlikely to result in the discovery of additional data. The attainment of saturation in the study may present an additional measure of validity.

Transferability of the study was achieved through thick description of the research process and the inclusion of diverse participants. Detail provided into the research process may enable other researchers to determine if the study is applicable to other research contexts (Castleberry & Nolen, 2018). Differences in participant gender, content area and grade level taught, years of classroom experience, and years of experience with Chromebooks all varied to ensure acquired data sets were transferable to other contexts.

Dependability of research was achieved through careful record keeping and note taking at all stages of the research process. Transparent descriptions of research steps taken enabled the establishment of an audit trail other researchers may use to follow methodology employed to ensure findings are consistent over time and replicable by others. Confirmability was achieved using triangulation and reflexivity. Implicit biases, assumptions, and past experiences were confronted to consider how study findings might be compromised and avoided. To address and avoid researcher bias, the use of leading questions was avoided and scripts for interviews (see Appendix J) and email correspondence were employed. Scripting ensured interview questions remained targeted, consistent, and focused on participant thoughts and experiences while preventing the interjection of personal comments or opinions. Open, objective body language was employed to encourage participant comfort and sharing, including eye contact and active listening techniques.

Chapter Summary

Data were collected from 16 participants using open-ended questionnaire items, interviews, and artifacts of instruction. Collected data resulted in the emergence of seven themes

aligned to three research questions: collaborative construction and presentation of knowledge, skills of research, including source credibility, student supports, extended student learning, student engagement, teacher supports needed, and barriers to instruction. Participants perceived Chromebooks develop 21st century skills in students by providing rich, differing opportunities to construct and present learning collaboratively and conduct research while evaluating source credibility. Teachers felt instruction with Chromebooks was specifically equipping students for the rigor of the 21st century by providing extensive opportunities for student support, promoting student engagement, and extending the learning process. Further, participants identified specific supports necessary for successful instruction with Chromebooks including teacher training opportunities and collaboration time with peers. Multiple measures employed throughout the study design process ensured the collection of reliable and valid data sets and analysis. Chapter 5 includes a discussion of research findings, implications of findings to previous literature on the topic and the theoretical framework utilized, describe study limitations, and present finding implications for the school leadership community.

Chapter 5: Discussion and Conclusion

Access to technology and the use of innovative tools continues to increase in classrooms resulting in greater numbers of teachers utilizing technology with students daily. Despite recent increases in access and use, it is unknown if tools of technology are being used effectively to prepare students for the rigor, innovation, and global competition of the 21st century. The purpose of the study was to explore teacher perceptions of ET use in a one-to-one Chromebook program. The study examined teachers' lived experiences instructing students with one-to-one Chromebooks to identify common perceptions and fill a gap in existing literature related to specific pedagogies teachers employ to foster the development of 21st century skills in students. Bandura's Social Cognitive Theory (SCT), an extension of social learning theory, was the theoretical framework for the study. Memories from personal past experiences with ET, as well as the observation of both positive and negative peer experiences may effectively predict teacher attitudes and the future success of one-to-one Chromebook programs. SCT guided the exploration of three research questions.

Data analysis from Chapter 4 revealed seven themes related to the three research questions. Themes emerging from exploration of Research Question 1 included the collaborative construction and presentation of knowledge and skills of research, including source credibility. When asked how they specifically developed 21st century learning skills such as creativity and innovation, critical thinking, communication, collaboration, and connection making, participants shared a wide variety of learning and skill building activities made possible using one-to-one Chromebooks. Additional participant commentary included both literacy and life skills, as well as emphasis on the development of information literacy and self-direction.

Exploration of Research Question 2 revealed three themes:(a) additional student support, (b) extended student learning, and (c) increased student engagement. Analysis of data from Research Question 3 resulted in the identification of two final themes, essential teacher supports and barriers to instruction. Comprehensive data analysis provided consistent, actionable strategies teachers used to promote 21st century skill building in students as well as insight into participants' lived experiences while using one-to-one Chromebooks to develop innovative skillsets.

Evaluation of prior research revealed limited information exists on the efficacy of ET, as well as specific guidance for practical implementation. A qualitative case study design was used to determine participant perceptions and included the use of an online questionnaire, semi-structured interview questions, and analysis of instructional artifacts provided by study participants. Table 3, located in Chapter 4, summarized themes emerging from each research question, the number of coding references to each theme, and the number of participants who discussed each theme.

Developing a better understanding of how Chromebooks may be practically used to develop critical 21st century skills may assist leaders with developing a functional understanding of how innovative skills are fostered in students by high-efficacy teachers as well as provide insight into how one-to-one Chromebook device programs should be structured for optimal teacher and student support and success. Such learning may lead to improved outcomes for students, increased access and achievement, and higher levels of instructional innovation by teachers. Teachers lacking support for ET or a practical knowledge of how to effectively deploy digital tools within curricular areas are unlikely to develop innovative 21st century skills in their students. Multiple counterarguments exist for the use of ET. Increased use of digital tools in

classrooms has been correlated with less verbal communication and feedback between teachers and students. Additionally, the efficacy of digital communication compared to face-to-face communication has been challenged, as has the lack of ability for ET to support active learning such as role play and collaboration. Finally, the use of ET simply for the “sake of technology” without clear thought and planning about best pedagogical practice has been shown to have negative impacts on teacher attitudes.

A description of this study’s findings in comparison to literature on the topic is provided, as are interpretations and conclusions drawn from data in the context of the theoretical framework. Limitations to the study are discussed and recommendations for future research and policy making are provided. Implications for leadership are explored and recommendations for action are made.

Findings, Interpretations, and Conclusions

Chapter 2 presented a detailed literature review focused on the exploration of teacher technology use and 21st century skill preparation. Two themes emerged from exploration of Research Question 3. Findings of the study validate existing knowledge presented in Chapter 2.

The provision of time for peer observation and collaboration about best instructional practices with ET was an emergent theme that may improve teacher attitudes and innovative practice. Study findings revealed teachers desired more time to collaborate with one another to discuss the use of ET. Providing structured time for collaboration may assist teachers with developing a rich understanding of how to use technology within specific content areas and avoid superficial use of ET that reinforces traditional pedagogies, including lecture or word processing. Failure to engage in peer discussion surrounding best practices within specific

contexts may lead to greater teacher risk and anxiety, resulting in less frequent attempts to use tools in a rigorous way.

Existing literature on the effective use of ET suggested teacher self-efficacy is critical to the successful implementation and deployment of digital tools (Zainal & Matore, 2021). When teachers' self-efficacy levels are low, ET is more likely used in a low-demand way or not at all (Delgado, 2018). Teacher self-efficacy levels may be positively impacted by providing time to collaborate with teaching peers utilizing digital tools in a successful way with students. Study results confirmed existing knowledge on the importance of building teacher self-efficacy through the provision of essential supports, as well as the inclusion of time for peer collaboration and observation.

SCT provides an explanation that individuals exposed to the positive experiences of others are more likely to replicate similar behaviors themselves. Teachers who collaborate with one another about best practices with ET are more likely to share successes and develop common lessons. As a result of peer collaboration, teachers experience more positive practices with ET and may demonstrate increased use of digital tools. SCT supports the importance of providing time for modeling, peer observation, and collaboration to teachers, as individuals lacking exposure to best practices and successes with ET are likely to demonstrate lower levels of self-confidence with technology and employ rigorous tools inconsistently or not at all. Additional research is necessary to explore how teacher perceptions of risk and confidence levels are impacted by peer observation and collaboration as well as establish recommendations for optimal time requirements that promote new learning and robust instructional practice with ET.

The need for timely, on-site support for teachers such as site-based technology coaches and professional development was a second emergent theme. Access to immediate support in the

event of hardware issues was essential for success as the need to troubleshoot devices and lessons occurred regularly for teachers employing ET. On-site, certificated technology coaches provided immediate access to support as well as consistent, site-based training, modeling, and mentoring for teachers struggling to implement ET into lessons. The provision of professional development to teachers was also essential, particularly training in Google for Education products as participant Chromebooks relied on Google software for effective functioning. Study findings supported existing literature stressing the importance of support systems for teachers utilizing digital tools, as systems designed to allow convenient access to one-on-one support from on-site mentors and hardware support providers as well as ongoing opportunities for training and professional development have been identified as essential to teacher success with ET (Gürfidan & Koç, 2016).

SCT confirms the importance of on-site ET supports for teachers, as consistent access to training and site-based coaching is likely to promote increased positive experiences with ET and improved teacher attitudes. Providing timely, immediate access to support and training in the event of technology failures is likely to result in the continued use of ET despite occasional struggles, resulting in continued teacher growth in proficiency with technology. Conversely, teachers experiencing frustration due to lost instructional time from malfunctioning hardware, struggles with student behavior management, or network outages with no access to immediate assistance may develop poor attitudes towards the use of ET, negatively impacting future use. Future research may explore on-site support delivery models to determine which is most effective in supporting and promoting ET use by teachers.

Barriers to instruction with ET emerged as an additional theme. Study findings supported the presence of barriers impacting the innovative use of ET, such as aging hardware, device

quantity, and the failure to service or refresh devices regularly. As devices failed, teachers engaged in time consuming device repair and troubleshooting to maintain desired one-to-one quantities for students and long wait times for off-site repairs or replacements resulted in teacher frustration. In addition to hardware considerations, consistent access to the Internet was essential for teachers employing Chromebooks, as network outages significantly impaired ET use and contributed to negative teacher experiences. Finally, classroom management of technology devices remained a significant barrier to instruction. Middle school students were easily distracted by devices, resulting in increased pressure on classroom teachers to ensure students remained appropriately engaged with lesson objectives. Findings supported existing literature on the topic, as a lack of access to digital tools, restricted access to the Internet, and a lack of support from administration have all been cited as barriers to the successful implementation of ET (Kilinc et al., 2018). In addition to external barriers, internal barriers such as negative teacher beliefs and attitudes about the efficacy of ET have been documented in the literature (Ardiç, 2021; Gaddis, 2020; Hyndman, 2019).

SCT explains how teacher reluctance to deploy technology may arise when negative experiences with technology occur. Teachers who lack local support from peers, mentors, or support providers are likely to encounter barriers with hardware or classroom management. The inability to secure timely assistance when devices fail, or networks are unstable may significantly impair teacher willingness to attempt the rigorous use of ET with students. Additionally, teachers who lack clear understanding of how to manage and monitor students on Chromebooks are more likely to experience lost instructional time and negative student behaviors, resulting in future reluctance to integrate technology into lessons.

Results of the study supported existing literature emphasizing the importance of time for peer collaboration and observation to build teacher efficacy, the necessity of on-site supports for teachers, and the presence of external barriers to instruction. Bandura's (2008) Social Cognitive Theory provided the theoretical framework for the study, proposing individuals learn new skills through the observation and successful replication of the actions of others. Study participants actively discussed how time spent with peers to share, collaborate, and model best practices for innovative instruction was essential to their professional learning and the success of ET endeavors, as was the presence of on-site support systems to promote professional learning and eliminate barriers to instruction.

Limitations

The study included three limitations. Participants from a single middle school in the same geographic location were included, resulting in a limited sample population. Tilton et al. (2017) explained the use of small cohorts of participants may increase case study depth and complexity, though may result in limits to generalizability to the wider population. As such, transferability of findings to populations in different locations or grade levels may be limited.

Dependability of research findings was an additional limitation. While the use of scripting ensured interview questions remained targeted, consistent, and focused on participant thoughts and experiences, the potential for participant exaggeration or attribution exists and could not be eliminated as a potential limitation. The acceptance of participant responses as truth could introduce limitations to dependability, however use of triangulation and member checking of interview transcripts served to increase credibility of the study. Additionally, confirmability of the study was achieved using NVivo qualitative data analysis software (Andrade de Souza Neto

et al., 2019) and the avoidance of leading questions that could introduce researcher bias (Allen, 2017).

A final limitation of the study was the inclusion of specific criteria for participation. All 16 participants used one-to-one Chromebooks to instruct middle school students in mathematics, science, social studies, or English language arts. Creswell and Poth (2018) explained phenomenological studies collect participant experiences through personally lived and told stories. As the study omitted the experiences of teachers instructing students with one-to-one Chromebooks outside of the four core content areas or at different grade levels, additional research is needed to determine study transferability to other content area teachers or to teachers instructing students at the elementary or high school levels. Study findings may be applicable to middle school teachers using one-to-one Chromebooks to instruct students in the core content areas of mathematics, science, social studies, and English language arts.

Recommendations

Participants shared thoughts about the innovative use of Chromebooks, including specific strategies used to build 21st century skills in students. Insights into essential supports needed and barriers encountered were also discussed. Valuable information obtained may be used by other schools or districts seeking to implement one-to-one device programs or assess the quality and impact of existing programs. Recommendations should be thoughtfully considered before the implementation of one-to-one Chromebook programs to ensure benefits outweigh investments in time and school funding.

Protecting Teacher Collaboration Time

School site and district leaders should ensure structured, scheduled time is provided to teachers seeking to utilize one-to-one devices with students. Teachers need time to share best

practices, collaborate with one another about successes and failures, and experiment with digital tools. Release time should also be provided to allow teachers to observe the instruction of peers utilizing ET in an innovative way as the observation of high efficacy peers has the potential to positively impact teacher attitudes related to technology. Additionally, providing regular, scheduled time for professional development with digital tools is essential. Teachers using Chromebooks need practical knowledge of how to use devices in specific content areas. Leaders should consider building time for collaboration and technology professional development into regularly scheduled late start days and staff meeting schedules. The use of grade level and department time for technology collaboration and experimentation focused on student needs should be clearly communicated by site leaders. Future research should focus on the types of professional development teachers find most beneficial as well as identifying an optimal frequency of training that provides for new learning and the ability to implement and practice new tools.

Providing On-Site Support

The provision of on-site support to teachers utilizing ET is essential. Access to immediate assistance in the event of hardware failure or device management issues is critical to ensure instructional time remains focused on lesson objectives as opposed to technology troubleshooting or maintenance. School leaders should designate a full-time technology coach to provide peer modeling, coteaching, and hardware assistance as necessary. Leaders should remain diligent about regularly checking in with support providers to assess the health of technology initiatives, such as device age, quantity, and replacement needs. As devices age, impacts to performance are more common, as are decreases in the number of devices available for student use. Resultant teacher frustration with aging or failing devices can negatively impact teacher

attitude and willingness to utilize ET with students. On-site coaches should regularly meet with administration to design professional development and site technology plans, provide status updates about device and network health, and make ongoing recommendations for next steps in the use of digital tools at the local level. Future research should examine on-site support models deemed most effective in promoting the rigorous use of ET to develop 21st century skills in teachers and students.

Promoting Innovative Use of Chromebooks

Proficiency with the use of one-to-one Chromebooks varies widely based on teacher skill, tolerance for risk, and attitude. The specific use of how Chromebooks may be used to develop 21st century skills in students represents a gap in the literature (HersHKovitz & Arbelle, 2020; Sauers & McCloud, 2018) and should be overtly taught to teachers. Professional development should focus on how teachers can use devices to promote essential 21st century skills, emphasizing collaboration between students and the effective communication of new knowledge. Strategies for developing research skills in students, such as how to determine the credibility of online sources, should be shared with teachers to promote the development of critical thinking skills. Expectations for the use of Chromebooks for student collaboration and presentation of knowledge should be included in teacher evaluation initiatives, and leaders should promote school-wide events and activities related to research building, similar to Hunt and McCracken's school-wide sustained silent reading initiatives of the 1960s (McCracken, 1971). Future research may examine how overt instruction in 21st century skill building for teachers impacts student technology use and proficiency.

Implications for Leadership

An implication for leadership from the study included the importance of developing teacher self-efficacy with Chromebooks to build positive attitudes and experiences. The provision of regularly scheduled time for teacher training and collaboration with peers has been identified as essential to the success of 21st century skill building programs (Dinc, 2019; Hamutoglu & Basarmak, 2020) and was supported by study findings. School site leaders should be cognizant the provision of devices or software without appropriate training and collaboration time with peers in content-alike areas is unlikely to result in significant change to traditional pedagogies (Delgado, 2018). Teachers lacking the skill to integrate innovative pedagogy into existing curriculum will likely find time constraints prevent the use of technology, as innovative practice is viewed as an extra task to accommodate as time allows.

Teachers need to explore activities that encourage the essential 21st century skills of online student collaboration and the innovative presentation of knowledge. To promote critical thinking in students, leaders may encourage the inclusion of units of study focused on skills of research and source credibility by providing targeted professional development and identifying on-site mentors or coaches proficient with developing critical thinking skills in students. Site leaders need to communicate expectations for 21st century skill building as a regular part of classroom instruction, and may tie such expectations to school vision, performance goals, or teacher performance evaluations. Such efforts may lead to increased skill development, student achievement, and long-term success in a globally competitive future.

The elimination of barriers to 21st century instruction is an essential consideration for site leaders. Collaboration with district technology support is vital to ensuring timely hardware troubleshooting, repair support, regular refreshment initiatives, and adequate device quantities.

The identification of an on-site support provider may ensure critical, timely assistance in the event of a technology failure or request for immediate assistance. On-site support providers may be provided partial schedules or release periods from classroom instruction to enable consistent time for troubleshooting or coteaching opportunities that model innovative instructional practice with peers needing higher levels of support with online behavior management or 21st century tools. Site leaders facing budget constraints for expanding technology initiatives may consider communication initiatives to additional stakeholder groups including parents and local community partners for assistance with device donation or fundraising plans. District personnel may also be recruited for assistance with grant writing or capital campaign initiatives.

Conclusion

Teacher self-efficacy is essential to innovative practice and is enhanced through the provision of time for professional development and collaboration with peers to develop a practical understanding of how to use Chromebooks in a specific context. Social Cognitive Theory, proposed by Bandura (2008), supported the finding that teachers need opportunities to observe the positive outcomes of others and collaborate with peers before attempting unknown behaviors themselves. SCT also supported findings that teachers experiencing negative impacts from hardware difficulties were less likely to use ET in a consistent, robust manner with students in the future, suggesting the presence of on-site technology support is essential.

Chromebooks enabled the development of student 21st century skills by promoting student to student collaboration, providing avenues for innovative and varied presentation of learning outcomes, and promoting the development of online research skills. While specific strategies used to develop 21st century skills varied by participant and content area, all were consistent with identified themes of student collaboration, presentation of knowledge, and

research skill development. The identification of specific activities that build 21st century skills represented new knowledge about how digital tools may be used by teachers to promote 21st century skill acquisition and long-term student success in an uncertain future and is valuable for school leaders seeking to implement or refine one-to-one programs.

Access to timely, on-site support is essential for teachers, as is the development of a robust understanding of how to manage and direct student online behavior. Frustration with time lost to malfunctioning devices or off-task student behaviors has the potential to impact teacher attitudes and ET implementation in a negative way. Participants' lived experiences as veteran educators and early adopters may provide valuable context and learning for site leaders seeking to promote innovative 21st century practices in schools. The innovative use of ET by teachers is critical for the long-term success of students navigating an increasingly technical and competitive world.

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Appendix A

Recruitment E-Mail Letter

American College of Education

[Date]

[Participant's Email Address]

Dear [Participant's Name],

My name is Jen Alcazar and I am emailing today to inform you of an opportunity to participate in a dissertation research study about 21st century skill development in students using one-to-one Chromebooks. I am a doctoral student at the American College of Education. The study seeks to understand and document the perceptions, views, and beliefs of teachers who use Chromebooks in their classrooms to instruct and build 21st century skills with their students, uncover essential supports necessary to do this work, and reveal barriers to success.

You have been identified for the study because you work in a middle school that utilizes one-to-one Chromebooks with students. Attached to this email is a letter of information as well as a consent to participate letter that explain fully the purpose and procedures of the research, any risks or benefits of participation, an explanation that study participation is voluntary and may be withdrawn at any time, and an explanation of your right to confidentiality.

You may choose to respond to this email for more information; doing so does not obligate you to participate in the study. Participation in the study is voluntary, and you may withdraw consent to participate at any time. While I may publish study results, your name will not be used or shared in any way, and your information will remain strictly confidential.

Please consider responding to this email so I may provide more detail and discuss next steps, including securing your signed consent to participate.

Thank you for considering this dissertation research opportunity.

Sincerely,

Jennifer Alcazar


jennifer.alcazar4448@my.ace.edu

Appendix B

Letter of Information

Informed Consent to Participate in Research

Title of Study (“21st Century Instruction: A Descriptive Case Study of a One-to-One Chromebook School”)

Introduction and Purpose

My name is Jennifer Alcazar. I am a graduate student at the American College of Education as well as the Director [REDACTED]. I am in the process of completing my doctoral degree in Science, Technology, Engineering, and Mathematics (STEM) Leadership. I am conducting research on the perceptions middle school teachers have on how one-to-one Chromebooks impact 21st century learning skills in their students. Below is information about the project and an invitation to participate in the research process. The purpose of this letter is to explain the research, begin to answer any questions you may have, and obtain your permission to participate in the study. My Dissertation Committee chair, Dr. Melissa Ortega, is working closely with me to ensure I meet all necessary research requirements as well as protect you and your confidentiality as a research participant. If you have any questions as we move through the process together, please do not hesitate to ask them.

Brief Description of the methodology

This research will involve your completion of an online questionnaire, as well as participation in a virtual (Zoom) interview which will take approximately one hour to complete in total. You will also be invited to provide instructional artifacts (samples) during the interview.

Participant Selection

I would like you to participate in my research study because of your unique experience in working with one-to-one Chromebooks in your classroom. I am interested in your perceptions of whether you think Chromebooks help to develop innovative 21st century skills in your students, as well as supports or barriers you have encountered in this work. You have been selected to participate if you have access to one-to-one Chromebooks and use them with students at least three times per week on average.

Voluntary Participation

Your participation in this study is completely voluntary. Should you choose not to participate, there will be no impact to you in any way, personally or professionally. If you agree to participate and later change your mind, you may cease involvement at any time.

Procedures

I am hoping you will be able to help me understand how a one-to-one Chromebook environment supports the development of 21st century skills in middle school students. To accomplish this, you will complete an online Google questionnaire that will allow you to share initial thoughts and impressions. After completion of the questionnaire, I will conduct an interview with you at a time of your choosing via Zoom technology. The purpose of the interview will be to allow you to

explain in more detail your thoughts and perceptions about using Chromebooks in your classroom. Should you consent for me to do so, I will record the interview using Zoom's recording feature and take notes to ensure I have accurately captured your thoughts. The video recording will be transcribed into a text file using Zoom's transcription feature and returned to you via email within 48 hours so you may review it for accuracy, should you wish to do so. You are also invited to provide artifacts (student work samples, lesson plans, rubrics) to the interview for the purpose of explaining/illustrating how you and your students use Chromebooks.

Duration

The research will take place over the span of two months, though you will only meet with me once unless you would like to meet again for me to answer questions or provide additional clarification. We will communicate by email to answer questions or schedule follow ups.

Risks/Discomforts

While I do not anticipate any risk or discomfort to you as a participant in this study, questions are designed to understand how you feel about using Chromebooks with your students and whether you believe students are developing necessary 21st century skills. For this reason, if you feel uncomfortable sharing any information with me, you are free to decline answering or stop your participation in the study. Your identity will only be known to me; your name will be collected for my purposes but will not be revealed in my findings. There are no right or wrong answers. With all research studies, there is a remote possibility that confidentiality may be compromised, however please be assured that I am taking necessary precautions to avoid this risk.

Benefits

Although there is no financial gain to you for participating in the study, your responses may help others using Chromebooks to understand how best to impact the 21st century learning of their students. You may also be able to provide critical information about the supports teachers feel are essential when using Chromebooks, or barriers that may be encountered along the way.

Reimbursements/Compensation

No compensation will be provided for participation.

Confidentiality

All of your answers will be handled with confidence, and your name will be disconnected from the information you provide. Any presentation of data will not utilize any personally identifiable material, unless you give explicit permission for its inclusion. All research files, video files, text transcripts, and artifacts you provide will be stored on a password protected laptop in a locked office at all times. When my research is completed, I will store these files for a minimum of three years in compliance with federal guidelines and then will securely destroy all files.

Sharing the Results

As a participant, you will receive a summary of research findings.

Rights to Refuse or Withdraw

Participation in research is completely voluntary. You are free to refuse participation at any time, either before or during the research process. There will be no negative impact to you should you choose to decline participation.

Who to Contact

If you have any questions about this research, please feel free to contact me at [REDACTED] or jennifer.alcazar4448@my.ace.edu. You may also contact the American College of Education, Institutional Review Board at 317-829-9400 or IRB@ace.edu.

Appendix C

Certificate of Consent

I have read the information about this study or it has been read to me. I have had the opportunity to ask questions about the study, and any questions I have asked have been answered to my satisfaction. I have been given a copy of this consent form to keep for my own records. I consent voluntarily to be a participant in this study.

Participant's Name (*please print*):

Participant Signature Date
[Optional/If applicable]

If you agree to allow your name or other identifying information to be included in all final reports, publications, and/or presentations resulting from this research, please sign and date below.

Participant's Signature Date

STATEMENT OF THE LEAD RESEARCHER

I confirm the participant was given an opportunity to ask questions about the study and all the questions asked by the participant have been answered to the best of my ability. I confirm the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Researcher Name: Jennifer Alcazar

Researcher's Signature Date

Appendix D

Institutional Review Board Approval Letter



December 21, 2021

To : Jennifer Alcazar
Melissa Ortega, Dissertation Committee Chair

From : Institutional Review Board
American College of Education

Re: IRB Approval

"21st Century Instruction: A Descriptive Case Study of a One-to-One Chromebook Middle School"

The American College of Education IRB has reviewed your application, proposal, and any related materials. We have determined that your research provides sufficient protection of human subjects.

Your research is therefore approved to proceed. The expiration date for this IRB approval is one year from the date of review completion, December 21, 2022. If you would like to continue your research beyond this point, including data collection and/or analysis of private data, you must submit a renewal request to the IRB.

Candidates are prohibited from collecting data or interacting with participants if they are not actively enrolled in a dissertation sequence course (RES6521, RES6531, RES6541, RES6551, RES6561, RES6302) and under the supervision of their dissertation chair.

Our best to you as you continue your studies.

Sincerely,

Tiffany Hamlett
Chair, Institutional Review Board
American College of Education

Appendix E**Permission to Conduct Research from District**

December 11, 2021

[REDACTED]

RE: Permission to Conduct Research Study

Dear [REDACTED]

I am writing to request permission to conduct a research study at [REDACTED]. I am currently enrolled in the doctorate program at the American College of Education based in Indianapolis, Indiana, and am in the process of writing my dissertation. The study is entitled 21st Century Instruction: A Descriptive Case Study of a One-to-One Chromebook School.

I hope district administration will allow me to recruit fifteen teachers from the school to complete an anonymous questionnaire, participate in an interview process, and submit artifacts of instruction related to the use of Chrome books for the development of 21st century skills in students. Participants who agree will receive a letter of consent for their signature (see enclosed).

If approval is granted, teachers will complete the questionnaire online, and then be interviewed via Zoom technology during a time convenient to them outside of instructional time. All questionnaire results and interview responses shall remain confidential and anonymous. Should the study be published, only pooled results and trends will be documented. There are no costs associated with participating.

Your approval to conduct this study would be greatly appreciated. Should you have further questions about the aims or methods of the study, please contact me at jennifer.alcazar4448@my.ace.edu or [REDACTED]. If you agree, please return the signed form that follows via email or submit a letter to me bearing your signature on letterhead indicating that consent.

Sincerely,

Jennifer Alcazar, Doctoral Candidate

Enclosures



[Redacted]



[Redacted]

December 14, 2021

To Whom It May Concern,

I grant permission for Jennifer Alcazar to conduct a research study at [Redacted] [Redacted] entitled "21st Century Instruction: A Descriptive Case Study of a One-to-One Chromebook Middle School."

Approved by:

[Redacted] _____

Signature:

[Redacted] _____

Print Name and Title:

[Redacted] Superintendent

Date:

December 14, 2021 _____

[Redacted]

Appendix F

Participant Questionnaire

Teacher Perceptions of a One-to-One Chromebook Program and 21st Century Readiness

Access this questionnaire at <https://bit.ly/2M0gJng>

About You

Thank you for providing some information about you and what you teach. All responses are confidential.

1. Your Gender:
2. Your Age Range: (circle)
 - 21-30 years
 - 31-40 years
 - 41-50 years
 - 51-60 years
 - Over 60 years
3. Years You Have Been Teaching:
4. How many years have you been teaching with Chromebooks?
5. Grade You Are Currently Teaching:
6. Content Area(s) You Are Currently Teaching:

About Your Classroom

1. How do you use Chromebooks to develop critical thinking skills in your students?
2. In what ways do you use Chromebooks to develop collaboration and communication skills in your students?
3. Do you find that Chromebooks help to develop skills of creativity and innovation in your students? How so?
4. What evidence do you have, if any, that Chromebooks help to develop self-direction skills in your students?
5. How do you use Chromebooks to develop global and local connection-making skills in your students?
6. Do you use your Chromebooks to develop any other types of skills in your students?
7. What supports do you feel are essential for teachers using one-to-one Chromebooks with students?
8. Have you encountered barriers to using Chromebooks with your students? Please explain.

Appendix G

Semi-Structured Interview Questions

1. The questionnaire you filled out asked you to explain how you develop skills in your students that have been identified as 21st century skills. These skills include critical thinking, collaboration, communication, creativity, innovation, self-direction, and connection making (both global and local). Before you is a copy of your responses. How might you expand or provide more detail on any of your responses?
2. You were also asked if there are any other skills you develop in your students using Chromebooks. Can you provide more detail about this?
3. The questionnaire asked you to share supports you feel are essential for teachers using Chromebooks. Can you provide more detail about those supports you feel are most essential?
4. The questionnaire asked you to share any barriers you have experienced as a teacher using Chromebooks with your students. Can you provide more detail about your response?
5. Have you brought any artifacts of instruction with you today? If so, can you explain them?
6. Are there any other thoughts you would like to share about using Chromebooks to develop 21st century skills in your students?

Appendix H

Subject Matter Expert Feedback Solicitation

After composition of the research tool was completed, a panel of subject matter experts (SME) was assembled to review the instrument and provide feedback for potential revision. Three SMEs responded to the request for feedback, indicating items were clear, non-contradictory, and comprehensive. One respondent posed a question unrelated to the purpose of the research resulting in no needed revision to the tool, while two others indicated the length of time necessary to complete the questionnaire with no suggestions for revision. Below is a screenshot including dates, times, and the content of the feedback received.



Chromebook questionnaire

8 messages

Hi tech coaches!

I am preparing a Google questionnaire for use in my dissertation research. The title of my study is "Instruction for the 21st Century: A Descriptive Case Study of a One to One Chromebook Middle School." I would love your feedback on the questionnaire if you have the time or inclination to provide it. Specifically, do you spot anything that might be confusing to my participants, or seems contradictory? I will revise the questionnaire based on your feedback.

After participants respond to the questions, I will meet with them for a one on one interview so that they can provide more explanation/insight into their responses.

Thanks in advance for taking a look and providing feedback to me. I value your expertise!

Access the questionnaire at <https://bit.ly/2M0gJng>

Feel free to reply to this email directly, and let me know if you have any questions at all.

Thanks so much!

Jen Alcazar

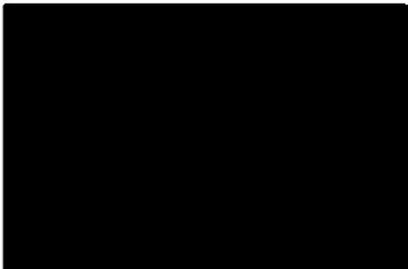


Sat, Aug 24, 2019 at 4:09 PM

Hi Jen,

I believe your questions are clear, comprehensive and non-contradictory.

Good Luck!



[Redacted]

Mon, Aug 26, 2019 at 3:44 PM

Finally gave you feedback! The questionnaire looks great. It probably took be around 20-30 minutes to complete it. I wasn't paying attention. Great questions!

[Quoted text hidden]

[Redacted]

Tue, Aug 27, 2019 at 5:07 AM

Thank you [Redacted]!

[Quoted text hidden]

[Redacted]

Wed, Aug 28, 2019 at 9:35 AM

Hi Jen,

Sorry for the late reply. There were so many emails to work through and respond that I can finally see the end of my "pile."

I think your questions are right on point! The only thing that I wondered is this: do you want to know if home access might be an issue? For example, when students work on assignments using Chromebooks in the classroom, what happens if they don't finish it before the end of the period? Are they expected to work on it from home? I don't know the main objective of your survey, but these are questions that I had.

Hope this helps. Good luck on your dissertation research!

[Redacted]

Appendix I

Emergent Codes, Collapsed Codes, and Resultant Themes

Emergent Codes	Collapsed Codes	Theme, Research Question (RQ)	Relevant Participant Quote
Collaboration Increased independence Accountability Online etiquette and integrity Technology literacy Ownership Present and demonstrate learning Creative expression Discover inspiration Resilience		Collaborative construction and presentation of knowledge (RQ1)	“I know as a master's candidate right now that they're making us do a tremendous amount of these things. Like infographics is a big thing; I make an infographic for every class I have. So I think, ‘hey that's what my kids are doing’, so it's a really great way to gain the 21st century skills [using Chromebooks]. That’s what the kids are doing and honestly, this is what their job is going to be like. We're not preparing our kids anymore to work in factories, we're preparing our kids to have graphic design jobs.”
Research Source credibility		Skills of research, including source credibility (RQ1)	“I have my students do a lot of research, especially in the area of science. When they write about their research they'll usually use the Chromebooks (using a Google document if it's something that they're doing as a group), they also do a share document which I like that they can all collaborate on together. When they're sharing their research, I also use other tools too, like Padlet or Flip Grid.”
Absent students Access to curriculum Assistive tech for communication	Access	Student supports (RQ2)	“A lot of teachers now, including myself, put up a document or an assignment (...) and every student has

High needs students – support required Intervention			access to it. As soon as they complete it, I'm immediately seeing it and can give immediate feedback. Again, the students are not losing things so it's huge for organization, because that's one of the things my students struggle with the most.”
Self-pacing Differentiating/leveling Content	Differentiation		
Communication to students Communication with other classes or areas Communication with parents Communication with teachers Reluctant communication (Students) Student-to-student communication	Ease of communication		
Student feedback to peers Self-correction	Feedback and Self Correction		
Balance on and offline Screen time concerns Executive functioning Self-direction Student organization Online safety Safe space to learn Self-advocacy Neuroscience	Student Wellness		
Access at home Alternate locations Alternate sources Alternate work times Application of content Assessment Data analysis Homework Progress monitoring Content review Extend assignment Make connections		Extended student learning (RQ2)	“Because you don't have primary resource artifacts in any library (...) and the programs that they use online allow you to look at them three dimensionally so not only can the kids see the artifacts but they actually can explore them three dimensionally which lends itself to a higher degree of learning (...) and analysis, because that's what we usually do is ask the kids to analyze the artifacts they're

			seeing to form their own conclusions about ancient history and what we can learn from it, so that is a significant difference in social studies.”
Games Student choice Virtual experiences Student planning Visualizing		Student engagement (RQ2)	“I had a journalist visit our class through zoom, she was so accomplished, she has published in National Geographic, the Washington Post, she worked for NPR. A really kind woman and she came to visit us, we did a Padlet and I had the kids post questions for her before she arrived. She shared with us, her information, her experience as a journalist and then (...) the importance of fact checking. Then she answered the kids’ questions. This is something that would have never happened pre-Chromebooks, just never.”
Problem solving Troubleshooting On-site support	Troubleshooting	Teacher supports needed (RQ3)	“The training, the IT support, the troubleshooting, it has to be on site. It needs to be (...) immediate, or a teacher will be like ‘Yeah, forget it, I’m not going to do this to myself.’”
Subscriptions/resources Teacher training Basic teacher proficiency Practical knowledge - how to use Professional development Risk to teacher Student assistance to teacher Teacher awareness of possibilities Teacher peer to peer for training	Teacher Training		
Curriculum planning Teacher learning - burden, time consuming	Time Considerations		

Time management and efficiency Time Saving			
Budget concerns Changes to hardware and software supports Device quantity (for all students) Different devices (variation) Hardware limitations Hardware refresh Hardware repair support Limitations of Chromebooks Wireless capability Working condition (device)	Hardware Concerns	Barriers to instruction (RQ3)	“It's hard for me to let go. I really have this thing about turning my back, on letting them just have the computer in front of them, because I don't trust them. Too many of them just want to play a game, or they pull up other things. So it's hard for me to just let them have free will. I didn't use GoGuardian [monitoring software], because I felt that added a lot of stress to the teachers that were using it to have to babysit even more. I let that go but I feel like (...) the kids can just open up games and tabs or whatever.”
Chromebook as reward Student distraction Student knowledge greater than teacher	Management and Monitoring		

Appendix J

Interview Protocol and Questions Aligned With Research Questions

<p>Interview Protocol for the Study on</p> <p>21st Century Instruction: A Descriptive Case Study of a One-to-One</p> <p>Chromebook Middle School</p>	
Participant Pseudonym Number/#:	Start Time:
Date:	End Time:
<p>Pre-Interview Script:</p> <p><i>Once again, thank you (participant pseudonym number/#) for your willingness to participate in the interview portion of this study. As previously explained, the purpose of the study is to understand the practices and perceptions of middle school teachers using one-to-one Chromebooks to develop 21st century skills in students in Grades 6 through 8. The research aims to document how teachers specifically develop these skills in students, as well as better understand supports and barriers encountered while doing this work. The findings of my study may provide valuable information to other teachers and school site leaders seeking to use Chromebooks to develop critical 21st century skills in their students as well.</i></p> <p><i>Our interview today will last about 30 to 45 minutes. I will be asking you to expand on the answers you provided to the Google questionnaire where you submitted responses to how you develop 21st century skills (such as critical thinking, collaboration, and communication). I will also ask if there are other skills you develop with your students using Chromebooks, what supports you feel you need that are essential for this work, and if you encounter barriers while using Chromebooks with your students. I will also ask you to explain any instructional artifacts or lessons you brought with you today, as well as share any additional, closing thoughts you may have about 21st century skill building using Chromebooks.</i></p> <p>Begin screen share to display informed consent form. Read form, answer any clarifying questions posed, and ask participant to sign digital form sent to participant's email.</p> <p><i>The informed consent form explains that I intend to record our conversation today. Are you still okay with me recording our conversation today? ____ Yes ____ No</i></p> <p><i>If yes, say: Thank you very much. If at any time during the course of our interview you wish for me to stop recording, please let me know. Do you have any additional questions before we begin? [Discuss any questions posed].</i></p> <p><i>If no, say: That is not a problem. I will not record our conversation. Instead, I will take notes on your responses. Do you have any additional questions before we begin? [Discuss any questions posed].</i></p>	

We are going to begin now. If you have additional questions or concerns at any point, please feel free to stop me and ask. As well, if you wish for me to remove anything you have said from the record at any point, just let me know.

Research Question 1: What are the perceptions of middle school teachers using Chromebooks to develop essential 21st century skills in students?

Interview Question: What are your thoughts about using Chromebooks to develop 21st century skills with your students?

Sub questions:

1. You have a copy of your responses to the online questionnaire before you. Can you please provide additional detail on how you use Chromebooks with your students to develop:
 - a. Critical thinking skills?
 - b. Collaboration and communication skills?
 - c. Skills of creativity and innovation?
 - d. Self-direction skills?
 - e. Local and global connection making skills?
2. You were also asked if there are any other skills you develop in your students using Chromebooks. Can you provide more detail about this?

Research Question 2: How do middle school teachers in a one-to-one Chromebook environment believe students are being prepared for the rigor and competition of the 21st century?

Interview Question: How do you feel your instruction is specifically equipping students with 21st century skills?

Sub questions:

1. You were invited to bring sample lesson plans or instructional artifacts today. If you brought these items with you, can you explain:
 - a. The context of the lesson.
 - b. How the lesson developed 21st century skills in your students.
 - c. How other teachers might use the lesson in their classrooms to develop 21st century skills with their students.

Research Question 3: What supports are essential for middle school teachers in a one-to-one Chromebook environment seeking to prepare students for the rigor and competition of the 21st century?

Interview Questions:

9. The questionnaire asked you to share supports you feel are essential for teachers using Chromebooks. Can you provide more detail about those supports you feel are most essential?
10. The questionnaire asked you to share any barriers you have experienced as a teacher using Chromebooks with your students. Can you provide more detail about your response?
11. Is there anything else you would like to add that I have not asked?

Post Interview Script:

Thank you again for your willingness to participate in this study. Your responses may prove very important to developing a better understanding of how Chromebooks may be used to promote critical 21st century skills in middle school students. Within 48 hours of this interview, you will receive a transcript of your interview that you may review for accuracy if you wish. As discussed before, if you have any questions even after our interview concludes, you are free to contact me at [REDACTED] or jennifer.alcazar4448@my.ace.edu