TEACHERS AND DIGITAL LITERACIES: MIXED- METHODS INVESTIGATION INTO 1:1 TECHNOLOGY-ENHANCED LEARNING ENVIRONMENTS

by

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DEDICATION

This dissertation is dedicated to my husband, Ron, my daughters, Carolina and Reese. You all have supplied me with love, encouragement, support, and laughter throughout this challenging process. To Mica, I appreciate your willingness to always listen and offer kind words to your baby sister. Many thanks to all my friends, co-workers, advisor, instructors, and students who have encouraged along the way.

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ABSTRACT

Despite the bustling technological landscape in which we live and learn, technology is still limited in its integration within classrooms. The current drive in education to promote 21st-century skills and digital literacies appears to remain relatively idle for a variety of reasons. This mixed-methods study examines the impact 1:1 technology has on digital literacies and the barriers faced by teachers with its incorporation into secondary classrooms. It explores the extent to which instructors within 1:1 environments perceive their technology integration and investigates how this indirectly impacts the acquisition of digital literacies within the classroom. By gaining more insight into how technology and digital literacy skills are integrated into 1:1 classrooms, we may gain insight into current integration practices as well as barriers to implementation, furthering literature in this area. Moreover, this research may enable educational systems to effectively align beliefs, research, and practice to support teachers in meeting newly adopted technologies and digital literacy standards.

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LIST OF ABBREVIATIONS

1:1	One-to-one
BYOD	Bring Your Own Device
DL	Digital Literacy
ICT	Information and Communication Technology
LMS	Learning Management System
LoI	Level of Integration
PEoU	Perceived Ease of Use
PU	Perceived Usefulness
SA	Stage of Adoption
TAM	Technology Acceptance Model
TEL	Technology-Enhanced Learning

CHAPTER ONE: INTRODUCTION

Technology integration within classrooms has been a key educational focus over the last two decades. The adoption of one-to-one (1:1) devices for students' use at home and school is quickly expanding as technology costs decrease and Internet accessibility broadens (Harper & Milman, 2016; Penuel, 2006). This technology adoption trend in K-12 education provides both advancements and challenges to the 21st-century classroom and the educators responsible for teaching in such environments. Hundreds of school districts across the United States have adopted 1:1 mobile learning devices such as laptops and tablets to support student learning, engagement, and acquisition of 21st-century skills such as digital literacy. Students preparing for their future endeavors need these skills to navigate our constantly evolving technology-based world. Students in 1:1 environments gain these skills by accessing technologies and applications inside and outside of the classroom to learn to effectively create, communicate, and collaborate (Stone, 2017; Lindqvist, 2015; Penuel, 2006). Thus, 1:1 technology environments are recognized as important, influential, and promising for students, advancing learning without the constraints of time, distance, and location (Bebell & Kay, 2010; Dunleavy, Dextert, & Heinecke, 2007; Lei, Conway, & Zhao, 2008; Oliver & Corn, 2008; Shapley, Sheehan, Maloney, & Carnikas-Walker, 2010; Tinker, Galvis, & Zucker, 2007; York, Lowenthal, Fabrikant, & Mayall, 2016). However, much of this promise is dependent upon the level of technology integration experienced in the learning environments.

Due to the rapid proliferation of ubiquitous computing initiatives within schools, the educational technology research community's scholarship regarding one-to-one initiatives has not to date kept up with the rapid diffusion or scope of such programs (Bebell & Kay, 2010; Lei, 2010; Lei, Conway, & Zhao, 2008; Penuel, 2006). Past one-to-one research studies have focused on similar outcomes of developing 1:1 programs (Bebell & Kay, 2010; Lei, 2010; Penuel, 2006), thus, it is necessary to extend this knowledge to encompass new developments in one-to-one initiatives which reflect the growth and evolution of mobile learning initiatives. Student experiences in 1:1 environments hinge upon teachers' acceptance and integration of 1:1 within the classroom, making educators a key component to successful programs. Therefore, it is imperative to research K-12 learning environments with 1:1 access to investigate both benefits and barriers to technology integration among teachers. Likewise, it is necessary to identify educators who embody the role of change agents to successfully implement 1:1 technologies.

Further, the expansion of the digital world has deeply impacted the educational landscape. As technology progresses, debate over what and how students learn 21st-century skills intensifies. These skills refer to a broad set of knowledge and habits believed to be critical in students' success in college and career paths (Partnership for 21st Century Skills, 2014). With emphasis on college and career readiness, the pressure to produce effective educational materials and learning experiences that promote success in a technology-driven world increases. Digital literacy is included within this set of "skills; still, its definitive meaning remains ambiguous.

The ubiquity of digital forms and its rapidly evolving nature are "transforming what it means to work, study, research, express oneself, perhaps even to think" (Littlejohn, Beetham, & McGill, 2012, p. 547). As such, the emphasis on teaching and learning in 21st-century classrooms requires the careful examination of what digital literacy means and the educational implications in framing such a highly contextual phenomenon. The USDOE (n.d.) posits that online learning and the use of technologies can "increase educational productivity by accelerating the rate of learning; reducing costs associated with instructional materials or program delivery; and better utilizing teacher time." Following this push, more schools have been implementing 1:1 and Bring-your-own-device (BYOD) programs to support learning in the digital age. Technology adoption and integration trends continue to grow, yet the manner in which digital literacy is taught and/or learned is not clearly defined, thus producing a range of inconsistency in secondary classrooms.

The increase of 1:1 laptop programs in secondary schools provides both advancements and challenges to teachers and students, whom Prensky (2001) labeled as "digital immigrants" and "digital natives" respectively. While 1:1 laptops may advance students' access to technology, instructors who are not tech savvy may find difficulty in utilizing new technologies as effortlessly as their student population, who have always lived within a digital world. Many schools continue to adopt school-wide 1:1 technology initiatives, but "achieving technology integration is a multifaceted challenge that entails more than simply acquiring and distributing computers" (Ertmer, 1999, p. 53). Moreover, educators are noting disparities in student preparedness in Information, Computer, and Technology (ICT) skills (Sorgo, Bartol, Dolnicar, & Podgornik, 2017), which are a

supporting component of being digitally literate. Therefore, it is imperative educators and researchers explore ways to integrate technology while also teaching students to be digitally fluent in using it, but again, how do education professionals achieve this without a clear definition or learning framework for doing so?

The context of digital literacy alone makes a holistic understanding of its acquisition difficult. Pangrazio (2016) noted, "Defining what is meant by digital literacy, however, has proven complicated, as the spaces, texts and tools which contextualize such practices are continually changing" (p. 163), which accounts for broad and varied definitions. Its traits, taxonomy, and components have evolved and diverged among scholars (e.g., Eshet-Alkali, 2004; Gilster, 1997; Ng, 2012) and amid educational policies and content standards. It overlaps, resides under an umbrella, and gets interchanged with terms such as media literacy, information literacy, computer literacy, and new literacy (Hinrichsen & Coombs, 2013; Walton, 2016), and while these terms are part of digital literacy history, this literature review focuses on current digital literacy definitions and framework components as well as its growing role in secondary schools. To frame the complexity of teaching within 21st-century classrooms, it addresses diffusion-adoption theory and 1:1 technology initiatives/integration and advocates the importance of digital literacy in classrooms while also reviewing shifts in pedagogy and issues associated with balancing curricular mandates with authentic learning, which places learners within context of real-world challenges and experiences.

Statement of the Problem

The increase of 1:1 laptop programs in secondary schools provides both advancements and challenges to this debate as teachers who are "digital immigrants"

struggle to teach whom they generalize as students who are "digital natives" (Prensky, 2001). While 1:1 laptops may advance students' access to technology, instructors who are not tech savvy may find difficulty in utilizing new technologies as effortlessly as their student population, who have always known a digital world. Many schools continue to adopt school-wide 1:1 technology initiatives, but "achieving technology integration is a multifaceted challenge that entails more than simply acquiring and distributing computers" (Ertmer, 1999, p. 53). The success of such initiatives is majorly influenced by the teachers' perceptions of technologies and attitudes toward the integration of technology into their classrooms (Tomlinson, 2015; Judson, 2006). Afterall, student use is heavily dictated by teacher instructional use. Therefore, it is imperative educators and researchers explore ways to utilize personal digital literacy skills and integrate technology while also teaching students to be digitally literate in using it within the classroom and beyond. It is essential to understand what barriers exist to achieving this multifaceted challenge and how they impact classrooms. Technologies and standards are increasingly adopted to emphasize the importance of technology integration and digital literacy, making it imperative to examine how their acceptance and use transform teaching and learning.

Purpose of the Study

Past research has indicated that students' exposure to ICT and digital literacy skills remains relatively low (Bekker et al., 2015; Ng, 2012). Students are expected to leave high school college-and-career ready. More universities and companies are expecting digitally literate recruits, and if classroom teachers continue to neglect digital literacies in the curriculum, the gap in possessing technology versus its fluent use will

only become more noticeable. Research already indicates that educators are noting disparities in student preparedness in Information, Computer, and Technology (ICT) skills (Sorgo et al., 2017), which are a key component of being digitally literate. In order to best prepare students for a digitally-literate life after high school, specific attention to the integration of technology and the development of digital literacy skills is paramount. The concept of technology literacy is increasingly becoming mandated within curricula, and decisions about the adoption of technology often occur at a higher organizational level. Successful implementation is dependent upon individual teachers' adoption patterns and beliefs (Straub, 2009; Hooper & Rieber, 1995). It is important to understand how educators integrate technology in the classroom and to explore how this may impact digital literacy instruction since teachers are the primary gateway through which technology-enhanced instruction enters the 1:1 classroom. Further, it is necessary to understand what influences teachers to adopt technology while others do not. Essentially, teacher experiences and perceptions of adopted technologies and standards impact student learning opportunities; therefore, it is beneficial to examine this relationship between teacher technology use and concerns as they relate to student exposure to digital literacies within classrooms. Because the concept of digital literacy is continually evolving right along with technology and differs within context, it is critical to utilize an encompassing definition for the purpose of researching it in the secondary TEL classroom. Taking into account past research (Beetham & Sharpe, 2010; Bekker et al., 2015; Belshaw, 2014; Eshet-Alkalai, 2004; Ferrari et al., 2012; Greene, Yu, & Copeland, 2014; Hatlevik et al., 2015; Hobbs, 2010; ISTE, 2015; Prior, Mazanov, Meacheam, Heaslip, & Hanson, 2016; Sparks, Katz, & Beile, 2016), digital

literacy is defined, within this study, as the responsible and appropriate use of technology to create, collaborate, think critically, and apply algorithmic processes. This includes accessing and evaluating information to gain lifelong knowledge and skills in all subject areas.

The integration of 1:1 technology into classroom instruction is directly related to teachers' disposition to accept the change (Atkins & Vasu, 2000; Knezek & Christensen, 2016; Sahin, Top, & Delen, 2016; Solomon, 2017). Within Roger's Diffusion Theory and Davis's Technology Acceptance Model (TAM), educators' adoption and integration of an innovation such as 1:1 technology into student learning activities is dependent upon perceptions of the technological tool's usefulness and ease of use (Davis, 1989; Maragunic & Granic, 2015; Rogers, 2005; Solomon, 2017; Teeroovengadum, Heeraman & Jugurnath, 2017). These perceptions are influenced by a variety of factors and may change given systemic influences and/or barriers, which past researchers indicate as impediments to the integration of technology (Bauer & Kenton, 2005; Ertmer, 1999; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Vongkulluksn, Xie, & Bowman, 2018). These barriers include, but are not limited to, equipment, time, teacher and student skill levels, and connectivity (Bauer & Kenton, 2005; Ertmer, 1999). This study seeks to explore what barriers are present when a primary barrier is removed: the availability of technology. In 1:1 classrooms, what barriers still exist (if any), and how do they affect digital literacy instruction?

The purpose of this study is an effort to explore teacher technology integration and digital literacy practices. The levels at which educators accept and utilize available technologies influence teaching methods when immersed in a 1-1 classroom

environment. This research will also examine what perceived shifts to teaching and learning exist as a result of teacher implementation. This researcher recognizes the nuances in the concepts of digital literacy, and for the purposes of this study, digital literacy will be defined as the responsible and appropriate use of technology to create, collaborate, think critically, and apply algorithmic processes in an ethical manner. This includes accessing and evaluating information to gain lifelong knowledge and skills in all subject areas.

Through a series of survey questions and interviews, this mixed-methods study aims to, first, explore commonalities among teacher respondents' technology integration practices in correlation to factors that may present as first or second-order barriers. The survey data analysis will explore the relationships between teacher technology adoption stages with 1:1 computing and teacher technology integration into the classroom curriculum. Secondly, the study will provide more contextual knowledge regarding the implementation and use of 1:1 computing in secondary schools and whether/how the utility of such devices is having a desirable impact on digital literacies, which may be acquired through instructional opportunities in 1:1 classrooms. Further, the findings of this study may aid administrators and school systems in identifying early adopters/change agents to serve as instructional mentors to other teachers (Rogers, 2005) and help inform decisions related to improving students' learning opportunities and to utilizing funds more effectively.

Rationale for Methodology

Mixed-method research combines the advantages of both quantitative and qualitative data and aids investigation into research problems that are complex and

require different perspectives to fully develop a picture of a phenomenon (Creswell, 2015). The dynamics involved within an organizational adoption of an innovation such as 1:1 devices in secondary schools are complex (Rogers, 2005). While districts adopt technologies for teachers to implement into classrooms, the educators are simultaneously assessing their personal adoption and technology integration within their courses. Though a correlation between teacher integration levels and perceptions may be quantifiable through the lens of adoption theory (Davis, 1989; Rogers, 2005), the influences of and/or barriers to such practices may only be understood through an exploration of "contextual, cognitive, and affective factors" (Straub, 2009, p. 627). Therefore, an explanation of the influences and barriers affecting this integration is necessary. A mixed method study with an explanatory sequential design is appropriate design for this study because both types of data are used to understand teachers' perceptions of adopted technology and what aspects help and/or hinder its integration in the classroom (Creswell & Plano Clark, 2011).

Research Questions

There is a need for more research examining teachers' attitudes and acceptance of technology and its integration into classrooms. As more states and districts adopt 1:1 devices and digital literacy standards, it is imperative to understand the barriers and facilitators affecting educators within 1:1 environments. To investigate this educational phenomenon, the study involves the following questions addressing how the adoption of 1:1 computing affects digital literacies in secondary education. This will be accomplished through mixed-methods data collection. While the relationships between teachers' technology integration and perceptions may be quantitatively expressed, there is a need to

further explore the influencing factors behind integration or lack thereof, which necessitates qualitative data collection. A mixed-method investigation of teachers in 1:1 environments may help educational institutions find ways to support educator digital literacies and technological innovation, and, in turn, impact student use. Through a brief quantitative questionnaire and teacher interviews, this study will explore teacher experiences within a 1:1 laptop environment.

Two major research questions guide this study. The quantitative aspect of this study will address research question one and two in addition to the sub-questions in an effort to identify relationships between teachers' perceptions of 1:1 technologies in the classroom with their reported stage of technology adoption. Through careful analysis of the data, teacher profiles may be created based upon commonalities in responses in relation to levels of adoption. By identifying relationships, if existent, between teachers' stages of technology adoption and perceptions of usefulness, ease of use, organizational factors, and teacher characteristics, the qualitative interviews will help identify common themes concerning the barriers and influences impacting technology integration into the classroom. The responses will allow a further look at how such factors attributing and detracting to technology integration are impacting digital literacies, a current priority in secondary educational institutions.

RQ1: How do aspects related to technology use affect digital literacies in the classroom?

Sub Question:

- What influences or impedes teachers' use of technology within classroom instruction?

- Is there a relationship between teacher opinions of technology and organizational factors, perceived usefulness, and ease of use?

RQ2: What does teacher integration of 1:1 technology look like?

Sub Questions:

- Are there similarities in teachers' stages of integration and teacher characteristics? (i.e., years of experience, content areas)

Because 1:1 programs in secondary education are mandated top-down, it is necessary to understand the affective variables that accompany such change. The qualitative interviews will be conducted to make further inferences into how specific factors affect teachers' use of technology in the classroom, thus affecting student digital literacies in the classroom. Straub (2009) notes that teachers are the experts in the classroom; students learn through the behaviors exhibited by the teacher. As such, digital literacies and technology skills are necessary teacher skills. While a school district may adopt and distribute devices to students, the teachers are charged with modeling and implementing the technology into classroom activities to promote student learning and digital literacies. It is through studying instructional perceptions and practices that researchers may find ways to promote the digital skills required beyond school environments.

Scholarly Significance

The intent of this study is not to merely report correlations and generalizations. This investigation will analyze teacher experiences to inform future research related to technology integration in secondary schools, which may substantiate findings among larger sample sizes. This mixed method study will contribute to research on the impact of

teacher beliefs on technology integration and, in turn, digital literacies. It addresses the relationships between perceptions of technology and its integration into classroom practices. The findings of this study will contribute to the existing body of literature regarding teachers' stages of integration of technology within 1:1 classrooms. Sahin, Top, & Delen (2016) found that teachers' attitudes towards technology decreased after teaching with 1:1 devices for a year. Teachers struggled with a lack of tech support. Proper training for teachers and students was suggested when transitioning from traditional teaching to 1:1. It adds to past research from Tondeur, van Braak, Ertmer, & Ottenbreit-Leftwich (2017) on the barriers of technology integration by exploring teachers' perceptions when a major barrier is removed: technology access. They posit that the interrelated factors that potentially impact teacher beliefs and technology use require better understanding. Lindqvist (2015) found barriers to also include distraction, tech problems, low level use of technology, and student resistance. Suggestion from Lindqvist's study included: alleviating technical problems, targeting low student laptop use, teacher collaboration, and teacher professional development, which may assist both teachers and students gain and sustain technology-enhanced learning (TEL) within 1:1 environments. This study helps fill the gap in the literature pertaining to secondary educators' perceptions of technology when adopted and mandated by the respective organizations within which they teach.

This study also adds to the research by examining how teachers' decisions to adopt and integrate technology affect digital literacies, another area of concern in K-12 education. Although this study focuses on two small school districts, it may offer insight for future research regarding 1:1 technology adoption and integration in K-12 schools,

particularly grades 6-12. Identification of relationships between teacher perceptions and their stages of technology adoption in connection to classroom practices may potentially support changes to educational technology professional development, which may strengthen teacher beliefs and integration practices. Such research is advantageous to schools and districts aspiring for increased technology integration into classrooms to promote digital literacy and technology standards. Expanding this research base may offer information useful for strengthening digital literacies among middle and high school students. By focusing on the instructional influences and barriers, this research may help educational stakeholders discover more effective ways to target 21st-century skills within classrooms.

Chapter One Summary

This chapter describes the study while offering insight into its significance to the field of teacher technology integration and digital literacies in the classroom. It relays the purpose of the study, states the research questions, and describes the rationale for the methodology. The second chapter provides a detailed review of the literature regarding diffusion theory, technology acceptance and integration, 1:1 technology initiatives, and digital literacies as they frame this study. Chapter three includes the methodology of the study, including its tools, context, sample, and research design. The results of each phase of the study are described in chapter four. They are followed by a discussion of the results answering the research questions and summary of limitations in chapter five. Chapter six concludes with the implications for professional practice.

CHAPTER TWO: LITERATURE REVIEW

The purpose of this literature review was to examine teachers' adoption and acceptance of 1:1 devices and technology integration to promote digital literacy. Digital literacy refers to "the ability to interpret and design nuanced communication across fluid digital forms" (Heick, 2021). In this review, its distinct sections address how the ways in which technology is diffused among educational systems influence integration efforts, thus impacting the acquisition and diffusion of digital literacy. First, I examine literature related to diffusion and adoption theory for individuals and juxtapose how it differs among organizations, particularly when innovations are adopted for users. This is followed by a review of the principles and purposes for 1:1 technology initiatives and the expectations for their integration and acceptance to support curricular mandates in the areas of technology and 21st-century skills such as digital literacy. I focus on the ways in which promoting digital literacy is complex and may be problematic for educators. Finally, I explore how the demands of teaching digital literacy through technology integration and authentic learning requires pedagogical transformation and a negotiation of traditional classroom roles. The literature reviews draw on peer-reviewed journal articles published primarily between the years 2006 and 2020. Keywords sought for this review include but are not limited to diffusion theory, 1:1, technology integration, and digital literacy. Journal articles that contained limited information regarding methodologies and instrumentation or that perpetuated digital nativism were excluded.

Additionally, I omitted most articles written prior to 2001, which often referred to outdated technologies or issues; however, seminal works were included.

Diffusion of Innovations & Acceptance of Technology

Stages of Diffusion

The Diffusion of Innovations explores the social processes which occur when new ideas/innovations disseminate among a group. According to Rogers (2005), diffusion is "the process in which an innovation is communicated through certain channels over time among members of a social system" (p. 5). Developed in 1963, this theory denotes the individuals of a specific system respond to new ideas with varying levels of interest and commitment, ranging from full implementation to complete rejection (Foulger et al., 2013; Rogers, 2005; Solomon, 2017). The adoption rate of a new idea/innovation is impacted by four main components: the innovation, communication channels, time, and social system/context. For the innovation to spread, it must be compatible among a group and demonstrate a relative advantage, "the degree to which an innovation is perceived as being better than the idea it supersedes" (Rogers, 2005, p. 212). This innovation adoption process occurs in five steps, beginning with knowledge and progressing to a final decision to adopt or dismiss an innovation (Rogers, 2005; Sahin, 2006).

According to Rogers (2005), the knowledge stage involves an individual's exposure to an innovation and understanding of how it operates. Individuals expose themselves to ideas aligning with their needs, interests, and attitudes and evade those in conflict with their predilections. At this stage, one is aware of an innovation, but he/she does not use it. It is this awareness knowledge that influences one to seek how-to and principles knowledge. An adopter needs to understand both how to use the innovation

properly as well as its underlying principles. Though it is "possible to adopt an innovation without principles-knowledge," "the danger of misusing the new idea is greater, and discontinuance may result" (Rogers, 2005, p.166). Change agents play an important role in this stage because they communicate knowledge and influence individuals in a direction agreeable with the social system. While much knowledge acquisition occurs within this first stage, it may also occur at later stages.

The intervention between knowledge and decision, persuasion occurs once the individual develops a positive or negative attitude toward the new idea. Here, an idea or technology's relative advantage, compatibility, and complexity are crucial to the individual and are also weighed against the innovation's consequences (Rogers, 2005). Individuals may communicate with others and seek more information about technology being considered (El Shaban & Egbert, 2018). At his point, the individual considers whether this new idea will be advantageous or potentially problematic. The formation of attitudes alone does not directly lead to an adoption; at times, an adoption may be preventive, elected in hopes of avoiding an undesirable occurrence later. However, this motivation to adopt is tenuous, and despite the need for and availability of such an innovation, adoption is slower or does not occur.

In the decision stage, an individual engages with the innovation and makes a choice to adopt or reject it. Adoption is "a decision to make full use of an innovation as the best course of action available" while rejection is merely the choice to not adopt it (Rogers, 2005, p.171). Individuals will evaluate the following attributes of the innovation: relative advantage, compatibility, complexity, trialability, and observability; thus, the diffusion of an innovation occurs, respectively, when the innovation is perceived

to be better than previous options; compatible with norms and values of the social system; easy to understand and utilize; triable prior to adoption; and generates visible results (Rogers, 2005; El Shaban & Egbert, 2018). Often, individuals will test out a new idea on a trial basis to evaluate any uncertainty regarding the innovation. If there is even the slightest advantage, the idea is usually adopted. This trial period may also end in rejection, active or passive. Once an innovation is decidedly adopted, integration commences.

The implementation stage follows the decision to adopt an innovation, wherein new ideas are put into practice and, at times, reinvented. Rogers (2005) describes reinvention as "the degree to which an innovation is changed or modified by the user in the process of its adoption and implementation" (p. 174). Because the implementation stage involves noticeable behavior change, uncertainty may exist, raising the need for more information seeking. Reinvention benefits the individuals undergoing the implementation process; it affords flexibility and customization of the innovation, which may make the ideas/technology more fitting to the context within which it is being implemented (Rogers, 2005). The more frequent reinvention of an innovation, the sooner the idea reaches the last stage: confirmation.

Confirmation is achieved as individuals and members of a group recognize the benefits of their adoption and integrate it into an ongoing routine. While this involves the promotion of the new ideas and/or technology to others, Sahin (2006) notes individuals undergoing confirmation seek support for their decisions, which risk being reversed within this stage (p.17). At this stage, effective change agents must offer additional support and guidance to adopters of the new innovation. Within school systems, this may

be an administrator, instructional partner, or teacher, but regardless of school role, what can change agents do to move adoption of technologies in schools to a tipping point? Research regarding technology adoption among faculty have previously focused on the individual processes of adoption, omitting the differences that come from organizational adoption processes (Shea, McCall, & Ozdogru, 2006). With more school systems adopting 1:1 computing initiatives, it is essential to explore the diffusion adoption process and how it changes once new technology is adopted by an organization.

Innovation in Educational Organizations

Rogers' diffusion theory is frequently applied to technological innovations (Sahin, 2006), wherein a technology is "a design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome" (Rogers, 2005, p. 12). This involves both hardware and software, but since hardware is "the tool that embodies the technology" tangibly (Sahin, 2006, p.259), there is more potential observability, thus the adoption of hardware such as laptops is increasing among educational systems. Tidd (2010) notes that the benefits of innovations may take years to reach full effect due to economic, behavioral and structural barriers. Thus, examining the adoption and integration processes of new technologies is complex within educational systems, which are organizational and include structural, political, economic, and geographical characteristics (Rudd & Watts, 2008).

Of Rogers' (2005) six variables determining the rate of adoption of innovations, two appear to affect classroom teachers' adoption and implementation practices: the nature of the social system (Buabeng-Andoh, 2012; Ertmer, 2005; Kearney, Schuck, Aubusson, & Burke, 2018) and the extent of change agentry exhibited (Butkēviča &

Zobena, 2017). Unlike individual adoption processes, the dependent variable in an organizational adoption process is implementation (Rogers, 2005). The five stages of the innovation process within an organization come in two phases: initiation and implementation.

The first two stages involve planning decisions made from the top-down, while the implementation stage involves putting the adopted innovation to use. When an organization (such as a school district) adopts an innovation, implementation does not directly follow; often there are multiple barriers and resistance to change within an organization since different individuals are involved. Such as the case with many classroom hardware adoptions, educators find themselves with contingent innovation decisions due to the structure and regulation of the systems in which they teach. They must make instructional decisions regarding integration of technologies adopted by outsiders for their classrooms, thus the adoption of an innovation by organizational officials makes implementation a challenge that involves the restructuring and routinizing of classroom contexts.

The hierarchical organization and rules within education systems impact the diffusion process. Often, the adoptive sequence of new technology is an administrative top-down process, meaning the hardware selected for schools is made by an executive group outside of the classroom wherein it is expected to be implemented. These administrative decisions mandate the presence of technology within the systems' classrooms, limiting educators' freedom to adopt or reject the innovation. Rudd and Watts (2008) assert, "the structure of a social system can facilitate or impede diffusion of innovations and thereby influence the rate of adoption of the innovation over time,"

resulting in consequences both direct and indirect, anticipated and unanticipated, and desirable and undesirable (p. 270).

To successfully integrate technology initiatives into classrooms, educational professionals must consider how their decision-making impacts classroom teachers. Ultimately, the two basic premises of the diffusion model are that communication is essential and that new innovations (whether products, practices, or ideas) "can alter the structure and function of a social system" (Rudd & Watts, 2008, p. 268). Since implementation is controlled by stakeholders uninvolved with the official adoptive stage and given that formal rejection of a systemic technology adoption is not permissive, educators must work within individual contexts to make the chosen innovation fit. Indeed, research confirms the powerful position educators' hold (Blackwell, Lauricella, & Wartella, 2014; Chen, 2015; Ertmer, 1999; Judson, 2006; Zhao & Cziko, 2001); they directly determine instruction, make decisions to implement (or not), and filter the educational agenda, making them crucial to technology integration processes and the overall success of an educational innovation. The variety of educators implementing new technology within such a system make reinvention not only likely but a necessity. As a trending innovation, computers are tools that "consist of many possible opportunities and applications, so computer technologies are more open to reinvention" (Sahin, 2006, p. 17). The increasing prevalence of 1:1 laptop program adoptions among school districts indicates educational promise, providing multitudinous resources to educators and students alike. The rate at which teachers can utilize 1:1 innovations requires more research to explore how it is integrated and reinvented within classrooms. As more

reinvention occurs, the more rapidly the adoption (Rogers, 2005), essentially leading to an innovation being institutionalized.

Technology Acceptance Model (TAM) & Adoption Theory

While diffusion theory illustrates a macro-perspective of an innovation's spread over time, adoption theory takes a micro-perspective, focusing on the elements that make up an individual's decision to change (Straub, 2009). The adoption of a technology by schools may be a one-time event, but there are multiple influences affecting educators' decisions to integrate the devices "adopted" for their use in the classroom. Davis's Technology Acceptance Model (TAM) (1989) posits that an individual's acceptance or rejection of a technology is influenced by perceived usefulness and perceived ease of use. The extended TAM (Venkatesh and Davis, 2000) considers the external factors such as social influence that are key in the diffusion process. This may include, but is not limited to, voluntariness, experience, job relevance, and output quality. In conjunction with Roger's Adoption Theory within an organization, teachers' stage of adoption will be impacted by organizational factors. Within school systems, the adoption, implementation, and change of devices may cause these perceptions to remain in a state of flux since the educators implementing the devices did not take part in the decision-making process.

1:1 Technology: Principles and Purpose

1:1 Technology

One-to-one computing refers to all students having access to a computer (often laptops) or mobile learning device (such as a tablet or iPad) as a personal tool to support their learning of school material in and out of the classroom (Islam & Gronlund, 2016; Penuel, 2006; Zucker & Light, 2009). Also known as ubiquitous

computing, 1:1 program adoption is a growing trend in education that aims to improve teaching and learning as well as minimize learning gaps among students of varying socioeconomic status (SES) (Warschauer, Zheng, Niiya, Cotten, & Farkas, 2014). This educational trend has been evolving for over two decades. Both Microsoft and Apple have sponsored and supported initiatives to help schools implement programs that provide computers to students for school use (Penuel, 2006), and hundreds of K-12 and higher education institutions are now involved in a variety of programs, implementing mobile computing (Moran, Hawkes, & Gayar, 2010). Penuel (2006) posited that the integration of technologies such as mobile computing is motivated by at least one of four motives: the improvement of student academic success, equity and access to digital resources, economic competitiveness in college and career readiness, and quality instruction. Research frequently equates 1:1 initiatives with increased achievement, equitable access, and improved instructional practices (Bebell & Kay, 2010; Keengwe, Schnellert, & Mills, 2012; Lei, 2010; Penuel, 2006; Shapley et al, 2010).

Highest student achievement is a prominent goal among schools, and often, systems seek to adopt the latest educational trends to boost student success. Shapley et al. (2010) examined the effects of 1:1 laptops on elementary students' math and reading performance scores; they concluded that student uses of computers for homework correlated to performance levels. Although results from their 2011 study were not significant, student achievement among students of low socioeconomic status (SES) positively improved with 1:1 laptops (Shapley et al., 2011). Likewise in other studies, students of low SES improved performance in math (Clariana, 2009; Rosen &

Manny-Ikan, 2011), literacy (Suhr, Hernandez, Grimes, & Warschauer, 2010), and narrowed achievement gaps (Lin, Shao, Wong, Li, & Niramitranon, 2011) within 1:1 environments. Despite small sample sizes and limited grades/content areas studied, these findings indicate a shared trend in improvement among student performance after 1:1 implementation and equitable resources for students.

Warschauer and Matuchniak (2010) note the vast "role of new media in the economy and society serves to highlight their important role in education" as it pertains to educational equity (p.180), further positing that "effective deployment and use of technology in schools can help compensate for unequal access to technologies in the home environment and thus help bridge educational and social gaps" (p.188). The implementation of 1:1 devices not only improves equity among student learners, but it also increases access to digital resources. Harper and Milman (2016) note the positive influences 1:1 programs bring to the classroom such as changes in learning experiences, differentiated instruction, and cooperative learning. Lei and Zhao (2008) found 1:1 environments enriched learning tasks such as Internet research and notetaking; likewise, studies found 1:1 access improved pacing (Clariana, 2009) and boosted engagement (Mouza, 2008). Several 1:1 studies documented changes such as more communication among students and teachers inside and outside of the classroom (Ingram, Wilcutt, & Jordan, 2008; Shapley et al., 2011; Storz & Hoffman, 2013), a more complex variety of research-based learning activities (Lowther, Inan, Ross & Strahl, 2012; Mouza, 2008), and more differentiated instructional practices (Hutchison, Beschorner, & Schmidt-Crawford, 2012; Milman, Carlson-Bancroft, & Vanden Boogart, 2014; Rosen & Beck-Hill, 2012). Such transformations to classroom activities

not only allow for more independent and personalized learning, but they also improve collaboration among students (Bebell & Kay, 2010; Lan, Sung, Tan, Lin, & Chang, 2010; Rockman, 2004). Previous research found 1:1 classrooms shift learning to be more student-centered environments (Klieger, Ben-Hur, & Bar-Yossef, 2010), allowing differentiation to become more prevalent. According to Holcomb (2009), such findings "suggests that 1:1 computing goes beyond the technology" (p.54).

Research has also indicated that 1:1 initiatives in K-12 schools aim to improve the quality of instruction to support 21st-century skills. Differentiated learning involves providing students with a variety of ways to acquire skills and learn content based upon their readiness and abilities. The task of differentiation requires skillful teacher planning and efforts; though both are still necessary, 1:1 technology programs have increased personalized, individual instruction (Hutchison et al., 2012; Milman et al., 2014; Rosen & Beck-Hill, 2012; Silvernail & Buffington, 2009). While all these intents and benefits positively impact the classroom, they may not do so unless instruction and technology have been purposefully integrated into course curriculum.

Technology Adoption and Acceptance

Technology has widely been accepted as a staple within educational systems due to its versatility and its depth and breadth of resources available through devices and Internet access. The National Education Technology Plan makes transforming "learning experiences with the goal of providing greater equity and accessibility" a national priority (USDOE, 2017, p.5). Among others, the 2016 NETP identifies ubiquitous connectivity and powerful learning devices as necessary components to such learning (Jones & Fox, 2016; USDOE, 2017).

Educational stakeholders and students alike benefit from technology adoption and integration initiatives. It is “a critical tool” to transform and personalize learning according to The Consortium of School Networking (CoSN). The National Center for Education Statistics (NCES) notes that approximately 75% of the United States population ages three and older utilized the Internet, an increase of 5% from 2011 (Snyder, deBrey, & Dillow, 2019). In 2014, the Federal Communications Committee (FCC) established three major connectivity goals for American public schools to support full technology integration. These include goals of Internet access speeds of 1Mbps (megabits per second), fiber connections to all schools, and Wi-Fi availability in all classrooms (Education SuperHighway, 2018).

With increased access to the Internet, student opportunities for learning abound, but this is dependent upon the emphasis and follow-through of educational stakeholders to implement available technologies into the learning environments. The 2018-2019 CoSN Infrastructure Survey found that while 92% of school districts met the Federal Communications Committee (FCC’s) Internet connectivity goals, “fewer than 10% of districts report students having access to non-shared devices at home” (CoSN, 2019). Further, they note that 40% of respondent districts have achieved 1:1 device status. Current research from the NCES prioritizes technology knowledge, skills, and attitudes as well as technology integration to improve K-12 education (Snyder, deBrey, & Dillow, 2019). This makes teachers’ integration of technology even more critical given accessibility gaps prevalent outside the classroom.

Paradoxically, the concept of digital technology has changed, and yet its integration has not. More schools have adopted programs to provide a mobile device to

each student; technology is more lightweight, more accessible, and less expensive (Moran et al., 2010; Penuel, 2006), yet the adoption of 1:1 devices merely signifies technology accessibility, not the degree to which they are integrated for learning purposes (Downes & Bishop, 2015). Ertmer and Ottenbreit-Leftwich (2012) note that despite the twenty-year presence of computers in schools, the majority of teachers have not utilized them in supporting meaningful student outcomes. Motivations remain focused on improved learning experiences, but at what level is technology being integrated/implemented?

Return on Investment

Advocates of 1:1 laptop programs have long extolled the value they add to the classroom. Contrarily, others (Cuban, 2001; Dunleavy et al., 2007; Oppenheimer, 2003; Weston & Bain, 2010) claim such pricey ubiquitous devices are often oversold to schools as a new solution for education and subsequently underused. Limited usage may stem from limited teacher training or Internet access, making 1:1 laptops costlier to strained educational budgets. Several studies note 1:1 usage varies across classrooms. Past studies denote most programs using the Internet use for research, word processing, and presentation applications; similarly, classroom management and technical difficulties were listed as common challenges to use (Bebell & Kay, 2010; Drayton, Falk, Stroud, Hobbs, & Hammerman, 2010; Dunleavy et al., 2007; Lei, 2010; USDOE, 2010; Weston & Bain, 2010). Overall, supporters for 1:1 technology-enhanced learning (TEL) praise the productivity of such school programs, but given broad usage variances, detractors weigh the cost against the overall utility, asking if

systemic ideas of innovation precluded evaluative research of such initiatives' potential return on investment. Becker (2000) posits:

> under the right conditions—where teachers are personally comfortable and at least moderately skilled in using computers themselves, where the school's daily class schedule permits allocating time for students to use computers as part of class assignments, where enough equipment is available and convenient to permit computer activities to flow seamlessly alongside other learning tasks, and where teachers' personal philosophies support a student-centered, constructivist pedagogy that incorporates collaborative projects defined partly by student interest—computers are clearly becoming a valuable and well-functioning instructional tool." (p. 3)

Therefore, continued research in 1:1 contexts is necessary to evaluate the degree to which favorable technological and pedagogical conditions support the acquisition of digital skills in current classrooms.

Student Achievement, Behaviors, and Learning

The hoped-for outcomes of increased student achievement and engagement are major promotion points of 1:1 TEL. Few studies have focused on these areas due to the difficulty in measurement and generalization. Those researched often found no significant difference in achievement scores as both teacher implementation and student usage vary (Dunleavy & Heinecke, 2008; Oliver & Corn, 2008; Williams & Larwin, 2016). Often, engagement is linked to higher student achievement, yet it is difficult to measure. Studies by Bebell and Kay (2010) and Shapley et al. (2010) utilized survey responses to elicit findings that increased student participation,

motivation, and interest could be attributed to the implementation of 1:1 laptops in the classroom. Such positive findings are promising but highly contextual, and as such, more research is necessary to probe for the impetus of such behaviors, which are noted desirable outcomes of TEL and the 21st-century classroom.

Studies by Dunleavy, Dextert, and Heinecke (2007) and Lei and Zhao (2008) concentrated on student behaviors and learning. Dunleavy et al. (2007) noted the continuous freedom of 1:1 laptops was a gateway to off-task behaviors, which required more vigilant classroom management. Similarly, Lei, Conway, and Zhao (2008) cite potential distractions such as games, music, e-mail, chat, videos, etc. afforded through constant Internet accessibility via individual devices. Though potential distractibility is not fully attributable to devices, it is imperative to seek the causation of such behaviors in 1:1 TEL because the same distractible computing tools can also teach communication, collaboration, and creativity (Oliver & Corn, 2008). Storz and Hoffman (2013) reported similar findings, noting positive and negative effects on student behaviors in 1:1 settings; though more distractions were readily present, classrooms were quieter during laptop usage. Further exploration into the context of 1:1 settings may present findings to avoid or encourage specific student behaviors exhibited within TEL activities.

Everyday Innovation

Lei (2010) tracked the transformations of one 1:1 project, noting its change from "bold innovation to an integral component of everyday teaching and learning" (p. 48). As technology became commonplace, student perceptions and technology usage evolved. Given the complexity of schools and their cultures, the dynamics of TEL are

affected by numerous factors; therefore, more research is needed investigating schools within which 1:1 TEL is an established component of the school's culture, teacher practices, and student academics. Over time, this reshapes device usage as perceived value of the laptops depreciates and as teachers redirect core curriculum foci. Drayton et al. (2010) explains technology maintenance is never complete as technology wears out or is "rendered obsolete by newer developments" (p. 45). With further research in 1:1 settings, insight can be gained regarding changes present in how students perceive available technologies once the novelty of 1:1 laptops fades.

Researchers agree more data is necessary to evaluate 1:1 as it relates to integration practices in the classroom (Bebell & Kay, 2010; Drayton et al., 2010; Lei et al., 2008; Oliver & Corn, 2008; Shapley et al., 2010; Storz & Hoffman, 2013; Tinker et al., 2007). The previous studies provide a foundational view of 1:1 in schools, but a more focused study on student perceptions of 1:1 TEL after initial implementation periods pass is necessary. Over time teachers gain knowledge and skills to utilize the laptops into course lessons, yet research is limited that examines the potential benefits these laptops afford students once they gain moderate operational skills set and once teachers have established effective technology-enhanced teaching practices. Research into seasoned 1:1 TEL environments may offer a more solid perspective of the diffusion and integration of technology to promote beneficial skill sets required of the modern classroom. Often, 1:1 programs establish goals and outcomes beyond curricular achievement; these may include the acquisition of 21st Century Skills deemed essential to future success in our technology-driven society (Sell, Cornelius-White, Chang, McLean, & Roworth, 2012). Further, the growing emphasis on 21st-

century classroom learning has shifted educational stakeholders to adopt standards and guidelines to align with digital literacy. Such mandates necessitate technology integration while simultaneously presenting pedagogical complexities, given the deictic nature of technology, the inconsistencies in terminology, and barriers to implementation.

Digital Literacy & Technology Initiatives in Secondary Education

Defining Digital Literacy

Recognized for creating its first definition, Paul Gilster described digital literacy as "the ability to understand and use information in multiple formats from a wide variety of sources when it is presented via computers and, particularly, through the medium of the Internet (Gilster, 1997, p. 6). While this description is particularly broad, its adaptability to the evolution of technology still stands. Just over twenty years later, the same need for skills to help users understand content, to evaluate messages, and to adapt within digital forms is still present. The International Literacy Association (ILA) 2018 Hot Report ranked digital literacy first in priorities among under-developed countries and fifth among developed countries. Here, digital literacy was considered as "teaching children how to compose and communicate using digital technologies as well as how to comprehend and evaluate information in digital forms" (p. 16). However, it was argued that including the word evaluate "took the topic into the territory of Critical Literacy" (p.16). Dissention over whether digital literacy solely includes a measurable set of skills or an equally immeasurable set of concepts blurs the lines among categories of literacy, making a clear definitive answer elusive.

Indeed, components of digital literacy make it a complex concept. Scholars emphasize its fluidity. It is a "mastery of ideas" (Bawden, 2008; Gilster, 1997, p. 15) rather than specific operational skills and tasks from a checklist. Not only does it entail skills and knowledge, but it involves cognitive and emotional skills in using technology (Eshet-Alkali & Chajut, 2009; Ng, 2012); attitudes to engage abilities to use digital media (Bekker, Bakker, Douma, van der Poel, & Scheltenaar, 2015; Hatlevik, 2015); problem-solving abilities and strategies to achieve outcomes (Bekker et al., 2015; Prior, Mazanov, Meacheam, Heaslip, & Hanson, 2016); creative abilities to compose, to reflect and think ethically (Hobbs, 2010), and self-regulated learning and epistemic cognition (Green, Yu, & Copeland, 2014). It is "culturally and socially situated" (Tour, 2017, p. 414), developed contextually (Beetham & Sharpe, 2008; Belshaw, 2014) and supported by technology, which also changes (Beetham & Sharpe, 2008). Prior et al. (2016) suggested that these variances make digital literacy an individualized set of abilities to use technology and interpret information for personal objectives. This constant metamorphosis in technology and context coupled with educational initiatives prioritizing digital literacy has rather problematized 21st-century teaching and learning.

Both new and veteran educators must integrate technology into course instruction with the dual purpose of meeting curricular standards and providing opportunities for students to practice digital literacy skills. While newly graduated teachers from collegiate educational programs may be acclimated to doing so, this can present challenges to technologically inexperienced teachers. The adoption of digital literacy standards applies pressure to adopt new curricular practices, but there are varied expectations regarding what teaching digital literacy entails. In order to "teach" digital literacy, an

operationalized definition must be in place. Essentially, digital literacy consists of both technological skills and ethical accountability. According to a report from the US Educational Testing Service (ETS), digital literacy:

> involves a variety of goal-driven interactions with information sources and products in digital contexts, including the ability to define and establish goals for information seeking and retrieval; successfully accessing relevant material; evaluating retrieved sources for their quality and reliability; organizing the information contained in those sources according to a scheme that suits one's purposes; making sense of varied and potentially conflicting information by integrating across multiple sources; and using that integrated understanding to answer questions, solve problems, or create digital media products that make effective use of information (Sparks, Katz, & Beile, 2016, p. 3).

Similarly, Lankshear and Knobel (2006) note how digital literacy not only consists of creation and communication skills; they emphasize that it encompasses critical interactions with information, within which people assess the validity, credibility, and reliability of the source and/or its content. This requires persons to question the source(s) of the information including how it represents the world and the interests of its producers and to understand the possible relationships to broader forces: socially, politically, and economically (Buckingham, 2010). Given that new technologies are constantly evolving, the emphasis of digital literacy must be on the attitudinal aspects more so than the technical. Citizens of the digital age must "solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically,

reflectively for work, leisure, participation, learning, socializing, consuming, and empowerment" (Ferrari, Punie, & Redecker, 2012, p.84).

For the purposes of this study, digital literacy will be defined as the responsible and appropriate use of technology to create, collaborate, think critically, and apply algorithmic processes in an ethical manner (see Table 1). This includes accessing and evaluating information to gain lifelong knowledge and skills in all subject areas.

Table 1 Areas of Digital Literacy

Area of Digital Literacy	Description	Citation
Create	Constructing new information and/or integrating prior content and knowledge. Generating information by adapting, applying and designing information in digital environments	Beetham & Sharpe, 2010; Belshaw, 2014; Eshet-Alkalai, 2004; Ferrari, 2012; Hobbs, 2010; ISTE, 2015; Sparks, Katz, & Beile, 2016
Collaborate	Link with others, participate in online networks and communities, interact constructively	Beetham & Sharpe, 2010; Belshaw, 2014; Ferrari, 2012; ISTE, 2015
Think Critically	Identifying digital needs, problem-solving through digital means, assessing and evaluating sources and information	Beetham & Sharpe, 2010; Bekker et al., 2015; Belshaw, 2014; Eshet-Alkalai, 2004; Ferrari, 2012; Green, Yu, & Copeland, 2014; ISTE, 2015; Prior, Mazanov, Meacheam, Heaslip, & Hanson, 2016; Sparks, Katz, & Beile, 2016
Apply Algorithmic & Technical Processes	Identify, locate, access, retrieve, store and organize information; use technology and media to perform tasks through digital tools	Beetham & Sharpe, 2010; Bekker, Bakker, Douma, van der Poel, & Scheltenaar, 2015; Belshaw, 2014; Eshet-Alkalai, 2004; Ferrari, 2012; Hatlevik, 2015; ISTE, 2015
Behave Ethically & Appropriately	Behave in an ethical and responsible way, aware of legal frames, including copyright, and communication through online tools, taking into account privacy, safety, and correct online behavior.	Beetham & Sharpe, 2010; Belshaw, 2014; Eshet-Alkalai, 2004; Ferrari, 2012; Hobbs, 2010; ISTE, 2015

Technology Initiatives & Digital Literacy in Secondary Classrooms

Since the creation of the USDOE National Education Technology Plan in 1996, education systems nationally have been steadily implementing technology initiatives. Even the Common Core State Standards Initiative (CCSSI) necessitates that the research, consumption, and production of media should be included into all curriculums (CCSSI, 2010; Hobbs, 2010). The Center on Standards, Assessment, and Implementation (CSAI) (2017) lists twenty-two states have adopted learning standards for information, digital, and media literacy, and more are following suit (see ALSDE, 2018). With more states creating standards to officially incorporate digital literacy into classrooms, it is important for stakeholders to review the implications these standards have on teaching and learning. While digital literacy is titularly labeled in some states' standards (e.g., Alabama and Massachusetts), it is tacitly embedded in others within broad concepts such as educational technology, library media literacy, computer technology, and information literacy (see CSAI, 2017). There is no doubt such standards are written with educational progress in mind, but, again, terminology and concepts overlap and differ across states, leaving digital literacy open for contextual and subjective interpretation (Barnwell, 2012). While this affords educational flexibility to a degree, it may conversely lead to issues with equity. Does digital literacy manifest differently in traditional classrooms versus 1:1 environments? Further, does the variability and ambiguity of policies and standards perpetuate a divide?

Rogers' idea that an innovation's "subjective newness" determines individual reactions is applicable to all fields, but

> "it is particularly relevant to educational innovations which frequently require teachers to change attitudes, relationships, and roles. There would appear to be no shortage of educational innovations and it is the implementation rather than the creation which presents certain difficulties and problems; and these will operate just as much if the idea or practice is new only to the individuals concerned or is 'objectively' new" (Nichols, 2018, p.3)

The growth of 1:1 TEL presents a variety of learning opportunities when integrated into authentic learning tasks, but the shift to student-centered instruction idealized in 1:1 TEL and digital literacy may require skills sets for which teachers are not traditionally prepared (Sell, Cornelius-White, Chang, McLean, & Roworth, 2012). Research finds that educators face barriers to technology integration (Ertmer, 1999; Kearney et al, 2018; Ottenbreit-Leftwich, Liao, Sadik, and Ertmer, 2018). First-order barriers may include a lack of resources, time, support, and/or knowledge (Ertmer, 1999; Hechter & Vermette, 2013; Hew & Brush, 2007; Inan & Lowther, 2010b; Kopcha, 2012; Pittman & Gaines, 2015), while second-order barriers denote classroom technology use is influenced by knowledge and/or attitudes (Ertmer et al., 2012; Inan & Lowther, 2010a; Miranda & Russell, 2012; Voogt & Knezek, 2008). Teachers must rely on educational training and knowledge to prepare and execute lesson plans integrating technology and promoting digital literacy, but the degree to which this is measurable, replicable, or done effectively is problematic. Ni and Branch (2004) addressed this complexity of education: educators "can arrange classrooms in various configurations... prepare and sequence instructional

materials to satisfy a linear order of events, but even educational technologists cannot guarantee the same linear order of a student's learning experience nor interaction patterns among peers, teachers, media, and context" (p. 30). The unique ways in which technology is used in everyday contexts presents a difficult challenge when engaging whole classrooms in digital literacy practices (Tour, 2017). With the current complex dependencies within educational systems and the wide range in beliefs, available technology, learning standards, and teaching philosophies, how can systems support teachers in successfully instilling digital literacy and its accompanying standards? Similarly, how can available systems support students? The mere creation of written standards will not incite the educational change necessary to support the development of new competencies (Hobbs, 2010).

Educational systems are too complex to have a one-size-fits-all answer to emergent innovations such as 1:1 devices or their use for digital literacy acquisition. This presents a major challenge for education systems, which must "leverage technology to create relevant learning experiences that mirror students' daily lives and the reality of their futures" (USDOE, 2010, p. 9). To realize this, a clear, common vision of instructional practice for technology utilization is needed to support the growth of digital literacy. The aforementioned states adopting standards indicate a step in this direction. The standards recognize shared responsibility across content areas to promote digital literacy and overlapping skills (CSAI, 2017; Reynolds, 2016; USDOE, 2010; USDOE, 2017), but due to the rapid state of change within our society, educational professionals must address learning targets that are in perpetual motion, begging the question: what does 21st-century learning and digital literacy look like? If we focus more on the

behavioral and conceptual aspects of digital literacy, how can we teach students to develop habits around the critical consumption of media and effective uses of technology for their current and future selves? More research will be necessary to chronicle progress towards digital literacy in secondary education and to reflect upon the current transformation of teacher roles within technology-enhanced learning environments required to accomplish these goals.

Technology-Enhanced Educational Environments

The increase of 1:1 programs in secondary schools has provided both advancements and challenges to the 21st-century classroom teachers and the students learning in such environments. High school students preparing for college/career settings need digital literacy skills to navigate the constantly evolving, technology-based world. They gain these skills by accessing technologies and applications in and out 1:1 classrooms to learn effective creation, communication, and collaboration skills (Lindqvist, 2015; Penuel, 2006; Stone, 2017). Thus, 1:1 technology environments are recognized as important, influential, and promising for students as they extend the opportunity to learn without the constraints of time, distance, and location (Bebell & Kay, 2010; Dunleavy, Dextert, & Heinecke, 2007; Lei, Conway, & Zhao, 2008; Oliver & Corn, 2008; Shapley et al, 2010; Tinker, Galvis, & Zucker, 2007; York, Lowenthal, Fabrikant, & Mayall, 2016). Since studies have found potential in 1:1 environments (Bebell & Kay, 2010; Dunleavy et al., 2007; Oliver & Corn, 2008), it is critical for research in the educational technology field to continue to investigate this evolving movement in education as a means of supporting digital literacy.

Instruction stands to be deeply affected by the changes accompanied by the implementation of 1:1 devices, but this is contingent upon their utilized purposes. Attitudes and experiences can strongly impact the reception and degree of use within coursework (Pierce, Stacey, & Barkatsas, 2007). With such environmental accessibility, these devices afford opportunities to engage with content and/or form learning habits, which mature over time (Lei, 2010; Storz & Hoffman, 2013). For successful integration and formation of desirable digital habits, users must see value in the utility of the devices (York et al., 2016). This value is dependent upon the experiences of students in the 1:1 classroom environment; therefore, educators, especially those noting these digital disparities among students, must be diligent and seek out technology-enhanced opportunities to address digital literacy in engaging and meaningful ways.

According to research study surveys, students hold positive attitudes toward 1:1 digital learning (Leslie, 2017; Lowther et al., 2012; Spanos & Sofos, 2015), and students have found working with laptops for school assignments challenging, relevant, creative, and individualized (Leslie, 2017). Nevertheless, positive attitudes towards digital technology do not necessarily equate to accurate evaluations of digital skills among students. Therefore, it is imperative for researchers to continue to monitor and explore the evolving 1:1 classroom environment to gain insight into digital literacy as well as teachers' and students' perceptions of their own abilities, skill sets, and experiences teaching and learning in technology-enhanced classrooms.

The New Divide: Digital Nativism and Digital Literacy

Students born after 1980 have been deemed "digital natives" due to their immersion in a technology-rich world during childhood and/or adolescence (Prensky,

2001). These so-called “digital natives” are assumed to manage Information Communication Technology (ICT) skills and tools (fluent use and navigation of technology such as computers, tablets, and the Internet) naturally, calling for new approaches to learning (Hatlevik, Gudmundsdottir, & Loi, 2015; Prensky, 2001; Sorgo et al., 2017; Ting, 2015); these students are touted to prefer “speed, nonlinear processing, multitasking, and social learning” (Thompson, 2012, p. 12). Though, acceptance of this claim leads to false assumptions regarding student mastery of educational technology use (Magrino & Sorrell, 2014), thus crucial opportunities to practice digital literacy go neglected by some teachers, a critical mistake given the rise of 1:1 environments and emphasis on digital literacy. Instructors must remember that “access to technology in the classroom is not enough; specific teaching about how to use technology is critical to ensure that we are not perpetuating a digital divide” (Langub & Lokey-Vega, 2017, p. 323).

The prominence and availability of classroom devices introduces a usage divide (Senkbeil & Ihme, 2017; Sorgo et al., 2017). The digital divide once known for separating the “haves” and “have nots” of technology is currently much more complicated; it has grown to encompass those who can use technology “in active, creative ways to support their learning” and those who cannot, “predominantly [using] technology for passive content consumption” (USDOE, 2017, p. 7). Studies found that tech-savvy “natives” tend to grasp a narrower range of tools and skills, especially in academic contexts (Dolan, 2016; Kolikant, 2010; Thompson, 2012). Despite technology’s omnipresence within student lives, this does not equate to technological omniscience. Many can use technology for personal purposes, such as entertainment

and informal communication, but many cannot use it effectively in classrooms or at work (Hobbs, 2010; Senkbeil & Ihme, 2017). Student practices outside school are limited, and there is a need for training in digital literacy skills for academic purposes (Bulger, Mayer & Metzger, 2014; Dolan, 2016; Ritzhaupt, Dawson, & Cavanaugh, 2012).

Instead of assuming students know appropriate educational technology usage, educators must provide opportunities to engage in digitally literate practices to prepare for college and career paths. For this transformation of digital literacy to occur, teachers must also be supported in learning with new technologies as well as integrating relevant and purposeful tasks targeting digital literacy into lessons (Blau et al., 2014; Dolan, 2016; Prior et al., 2016; USDOE, 2017). Both teachers and students need time and support to channel the latest technologies into opportunities to implement such practices.

Digital Literacy for Lifelong Learning

The critical thinking skills required within digital literacy is a necessity in traditional, online, and blended learning environments. They play an important role in higher education classes as well as workplace settings (Senkbeil & Ihme, 2017). The Partnership for 21st Century Skills (2009) categorized essential skills for successful transitions into a 21st century global society: information, media, and technology skills; learning and innovation skills; and life and career skills, which all have ties to digital literacy skills. Scholars noted that personal technology use differs greatly in amount and purpose to academic use (Sorgo et al., 2017; Ting, 2015), and students struggle to locate, comprehend, vet, and incorporate information from electronic sources (Greene,

Yu, & Copeland, 2014; Selwyn, 2009). This is due, in part, to the seemingly polar purposes of technology values and use in context, since home and school demand noticeably different skills and tasks necessary, such as entertainment opposed to academic writing and research (Gurung & Rutledge, 2014). Kolikant (2010) stated:

> the tension between the value systems must therefore be resolved, and it is this author's belief that schools should assume the responsibility for this. This does not mean that the school should adapt itself to the students' value system, or that it should more successfully adapt the students' value system to a 'person solo' perspective. Rather, the school should explicitly acknowledge the existence of these separate value systems and the relative advantages and disadvantages of both, helping students to consciously and selectively use different and sometimes contradictory values and practices for their learning purposes. (p. 1390)

Often, students and teachers alike are bombarded with various technology tools, but none are used consistently or frequently enough to equate with true digital competency. Therefore, it is imperative that educators offer opportunities to engage with technology while honing these critical 21st-century learning skills; it is equally "important that these opportunities link to student knowledge gains" (Greene et al., 2014, p. 55). Experiences with technology need to build knowledge, not only of content but skill sets, necessary to enter the adult world prepared.

Instructors must first be able to use the available technologies, tools and networks to research, organize, evaluate, and communicate information while also understanding the ethical and legal issues regarding the access and use of information.

Further, the instructors must also be able to cohesively blend these concepts with the curriculum to provide opportunities for students to practice digital literacy skills. Greene et al. (2014) noted added it is critical to plan and gauge the success of strategies used to navigate the vast Internet content available.

However, these same experiences must also apply to teacher learning. For students to acquire digital skills, the teachers must also be digitally literate. The system to classroom approach in implementing new technology and standards must also be sensitive and supportive to teachers' digital needs. The ambiguity of digital literacy and its highly contextual nature within set standards leaves stakeholders with unclear vision (Ertmer & Ottenbreit-Leftwich, 2013), causing "misunderstanding, misconceptions, and poor communication" (Eshet-Alkali, 2004, p. 94). Past research indicates one-size-fits-all professional development perpetuates this issue as teachers are also in need of authentic learning experiences necessary to implement digital literacy standards (Ertmer et al., 2012; Polly & Hanafin, 2010).

Supportive and Authentic Learning

Prior et al. (2016) found "it can be difficult for teachers to calibrate their own expectations with actual student capabilities, while also overcoming students' beliefs about their own digital literacy" (p. 93). Finding the balance in student perception, teacher expectations, and the reality of actual skills can be a struggle, but with thoughtful planning and proper support, both parties may appreciate the various opportunities present when technology is integrated successfully to practice digital literacy. Because a strategic design is necessary for such personalized learning, educators must not only take standards into account but also skills applicable to student

experiences (Moeller & Reitzes, 2011). This negotiation of sorts requires educators to encourage computer use and promote digital literacy, allowing students to experience/apply these skills in online learning contexts, thus supporting self-efficacy (Prior et al., 2016).

Engaging and meaningful learning can be accomplished through intentional, cooperative, and authentic activities, connecting students' digital literacy to real situations (Gurung & Rutledge, 2014; Howland, Jonassen, & Marra, 2012; Ng, 2012; Ting, 2015). Such opportunities within lessons can help students build self-efficacy and autonomy for learning individually (Ting, 2015). Students need a purpose to engage in new online activities or with new tools (Ng, 2012), and teachers play a crucial role in creating opportunities for authentic learning tasks with technology (McKnight, O'Malley, Ruzic, Horsley, Franey, & Bassett, 2016). But, how are teachers to impart digital literacy into lessons while learning alongside students with such contextual and complex concepts? In order to accomplish masterful technology integration and digital literacy strategies into the classroom, an examination and transformation of instructional roles is warranted.

Transforming and Supporting Roles in Education

The 21st-century classroom thrives upon technology implementation to advance student learning and digital literacy while being deemed innovative. The adoption of 1:1 initiatives and digital literacy standards have contributed to the metamorphosis among instructional and supportive leadership roles within classrooms and their respective systems. Indeed, the newly transformed role of educators is a complex and difficult challenge (Freeman et al., 2017); the growth of educational technology

imposes a move "move from a teaching system focused on transmission and repetition to a system based on action, compromise, critical awareness and the capacity to take risks (Sancho & Padilla, 2016, p.62)." The teachers of 21st-century classrooms must work with new technologies and in interactive, collaborative, and innovative ways with students, other instructors, administrators, and other stakeholders to prepare students to successfully learn and achieve within technology-enhanced environments. The abundance of and ease of access to information has forced instruction to evolve beyond knowledge dissemination and to focus more on the guidance, facilitation, and motivation of student learning (Cheng & Ching, 2007; Littlejohn et al., 2012; Tømte, 2013; USDOE, 2017), thereby shifting to a student-centered approach. Teaching involves the process to initiate, facilitate, and sustain students' self-learning, self-exploration and self-actualization; educators must support safe access to technologies while also sharing the decision-making responsibilities related to selecting media and digital tools and the evaluation of resources, thus perpetuating a collaborative partnership between students and instructors, which must be reevaluated over time (Gillett-Swan & Sargeant, 2017). This role shift relates primarily to digital literacy "because technology enable[s] student access to multiple resources and perspectives…[decreasing] the reliance on the teacher...[shifting] the role toward guiding students to manage their own learning" (McKnight et al., 2016, p. 205).

To facilitate such change within the classroom, instructors must be digitally literate in the technologies available to guide others, but Kay (2006) noted a majority of teachers are unprepared in these areas, and as technology evolves, a gap is forming between what technologies educators are trained to regularly use and the latest tools

available to support the current concepts of digital literacy (USDOE, 2010). This limits the learning opportunities that target digital literacy made available to students, which are acquired through "continued development" and matured when practiced in context through authentic tasks that are relevant to their choices of study (Eshet-Alkalai & Chajut, 2009; Littlejohn et al., p. 550). The USDOE (2010) suggested educators become "collaborators in learning, seeking new knowledge and constantly acquiring new skills alongside their students" (p. 3). This idea contrasts with the traditional concept of the teacher expert, who disseminates knowledge to an inexperienced audience. While it relieves teachers of the burden of expectations to be all-knowing in a content area, it does require digital literacy and the ability to utilize available tools to engage students with a growth mindset and problem-solving capabilities, thus modeling the desired skills and behaviors in context (USDOE, 2017). It is the concept of digital literacy and authentic practice that demands this change in pedagogy and affords instructors the opportunity to learn with and from students in a collaborative manner.

Teachers bear an unmistakable role in the success or failure of technology initiatives (Bebell & Kay, 2010; Chen, 2014; Ertmer & Ottenbreit-Leftwich, 2012; Judson, 2006; McKnight et al., 2016; Penuel, 2006; Vongkulluksn, Xie, & Bowman, 2018), and, thus, a role in the success of digital literacy learning within schools focused on preparing students to function in a technology-driven world. Because trending technologies are powerful, albeit evolving, tools for acquiring the latest digital literacy skills, teachers must be continuous learners, evaluators, and modelers of technology usage within the content areas being taught, which requires training and contextual

practice. This cannot be done without proper support from administrative and district leadership, nor can it be achieved through the typical one-size-fits-all professional development sessions that too often plague education systems (Freeman et al., 2017). Support must reflect the values of the standards for digital literacy, which includes professional learning experiences that mirror the authentic learning suggested by research (Ertmer et al., 2012; Gillet-Swan & Sargent, 2018; McKnight et al., 2016; Polly & Hanafin, 2010). The National Educational Technology Plan recognized, "The transition to technology-enabled preparation and professional development will entail rethinking instructional approaches and techniques, tools, and the skills and expertise of educators who teach in these programs" (USDOE, 2017, p. 28). Again, the highly contextual nature of practicing digital literacy poses a problem. How are educators to reflect digitally literate practices in student-centered ways when their training does not provide experiences relevant to learning contexts?

Despite recognizing the revision of teacher roles and professional development, educational solutions to surmounting this challenge remain elusive (Freeman et al., 2017). The technologies necessary to transform education and promote digital literacy may be available, but educators, administrative leaders, and policy makers must adapt to the changes necessary to effectively accomplish these goals. While technology does present instructional and managerial barriers (Ertmer, 1999), the challenge in 21st-century classrooms is the complexity with which teachers must prioritize learning goals and curriculum standards while also motivating, facilitating, and sustaining students' self-learning and self-fulfillment (Cheng & Mok, 2007). This multifaceted challenge is perhaps why research is so scarce, but it is nonetheless further cause for the evolution

of teaching practices within 1:1 classrooms, most notably the attention to individual student needs to practice digital literacy.

Conclusion

There is no doubt that integrating digital literacy practices is non-negotiable in 21st-century classrooms; it is the means through which educators may aid students in critical thinking, problem-solving, and meta-cognition related to their learning and provide ways in which students may showcase their skills (USDOE, 2017). But, the inclusion of digital literacy into educational curriculum also presents complex problems, which will require solutions if it is to impact instruction and learning. The contextual qualities of digital literacy do complicate its inclusion into curriculum, but there are some solutions to help with the educational transformation it requires.

First, the entities adopting digital literacy standards lack a common language, making interpretation subjective, miscommunication inevitable, and implementation erratic. Further, the presence of standards does not equate the equal observance within varied classrooms. Policymakers might consider collaborating on a common language for digital literacy standards to avoid misunderstanding among educators. The complexity and fluidity of digital literacy provide difficulty in formulating a standardized terminology. Second, the acceptance of digital nativism perpetuates the growing divide among students who can and cannot utilize technology to support learning. The presence of a device does not equate its fluent use; therefore, instructors must take care to be unassuming of student skills, offering both opportunities and support to utilize technologies academically. The inclusion of technology needs assessments might help avoid false assumptions of student abilities; likewise, it would

offer insight into the most beneficial types of learning experiences to include into courses. Lastly, the ease and access students have to knowledge have transformed the roles of teachers. As guides and facilitators, they must model digital literacy and lifelong learning, sometimes in conjunction with students, which requires careful balance, time, and support from school leaders. Educational leaders must consider the revision of teacher training programs. Since technology and education are intertwined, it may be of benefit to require more required educational technology credit for certification. For current teachers, districts and leadership teams should consider the addition of more educational technology support staff to aid teachers in combining the content and digital literacy standards into the classroom.

Though it does present barriers to teaching and learning, digital literacy is one of the most promising directives for the future of education; therefore, it is critical for researchers to explore the ways in which educators are navigating educational content in 1:1 environments given the increasing demand for digital literacy integration and negotiating their dyadic roles within classrooms. Student digital literacy skill development will improve in 1:1 classrooms as individual teachers gain wisdom and adapt to role changes (Blau, Peled, & Nusan, 2014). Greater integration of technology, teacher training, classroom support for out-of-school literacy practices, integration of technology in all curriculums, and digital literacy instruction are potential prospects for achieving the changes necessary to improve digital literacy in secondary education (Dolan, 2016).

Chapter Two Summary

Chapter two presented a literature review for this educational research study. It begins with a discussion of diffusion theory and the acceptance of technology. It then progresses to address 1:1 technology adoption in schools; it explores the principles and purpose behind these adoptions. It concludes with a review of digital literacy and technology initiatives in secondary education.

CHAPTER THREE: RESEARCH DESIGN & METHODOLOGY

Introduction

Online learning and the use of technologies can "increase educational productivity by accelerating the rate of learning; reducing costs associated with instructional materials or program delivery; and better utilizing teacher time" (USDOE, 2021, para. 2). As technology progresses, debate over what and how students learn 21st-century skills intensifies. These skills refer to a broad set of knowledge and habits believed to be critical in students' success in college and career paths (Partnership for 21st Century Skills, 2014; ISTE, 2007). Given the emphasis on college and career readiness, the pressure upon teachers to produce effective educational materials and learning experiences that promote success in a technology-driven world increases. Collectively speaking, digital literacy is a set of such skills, which includes "the ability to use, understand and evaluate technology, and also to understand technological principles and strategies required to develop solutions and realize specific goals" (Bekker et al., 2015, p.29). Nonetheless, if educators are not integrating technology and opportunities to practice digital literacies, then how will students acquire these prioritized skills?

To explore this aspect of emerging technologies, the mixed-method research study employed both an online survey instrument and interviews for data collection. The research utilized descriptive statistics, Pearson correlation analysis, and qualitative data coding and analysis to investigate technology integration and the possible relationships between technology adoption rates and teacher characteristics and organizational factors.

The alignment of research questions, data, and data analysis is presented in Table 2. The results of these analyses are detailed in chapter 4. The research focused on secondary school teachers within 1:1 technology-enhanced learning environments in the United States.

Table 2 Alignment of Research Questions to Data Analysis

Research Question	Data	Data Analysis
How do aspects related to technology use affect digital literacies in the classroom? What influences or impedes teachers' use of technology within classroom instruction?	Survey Questions [4-10] [adapted from Teacher Technology Questionnaire (TTQ) (Lowther & Ross, 2000) and The Stages of Adoption of Technology (SA) Survey (Christensen, 1997)	Descriptive statistics including frequencies, mean, median, mode, standard deviation
Is there a relationship between teacher opinions of technology and organizational factors, perceived usefulness, and ease of use?	Interview questions [2-7] adapted from Survey Questionnaire for Teachers Using Computer Technology (Bauer & Kenton, 2005) [See Appendix B]	Pearson Correlation Data from interviews were coded for barriers to technology integration, digital literacy, and emergent themes
What does teacher integration of 1:1 technology look like? Are there similarities in teachers' stages of integration and teacher characteristics? (i.e., years of experience, content areas)		

Tools

Survey questions were inspired by and adapted from the Teacher Technology Questionnaire (TTQ) (Lowther & Ross, 2000), which assesses teachers' perceptions of computers and technology, to address teacher perceptions when in 1:1 technology-enhanced classrooms. The TTQ has been validated and used in several research and evaluation studies (Inan & Lowther, 2012; Lowther, Inan, Strahl, & Ross, 2008; Corbeil & Valdes-Corbeil, 2007; Grant, Ross, Wang, & Potter, 2005; Sterbinsky & Burke, 2004; Lowther & Ross, 2000). The reliability of the TTQ was tested on 4,863 teacher participants in research projects by the Center for Research in Educational Policy. Questions adapted from the TTQ require teachers to rate their level of agreement with statements regarding 1:1 technology-related areas: impact on classroom instruction, impact on students, teacher readiness to integrate technology, overall support for technology in the school, and technical support. Items are rated with a five-point Likert-type scale that ranges from (1) Strongly Disagree to (5) Strongly Agree. Inan and Lowther (2012) note the instrument's reliability coefficients as high for each subscale within the instrument, ranging from .75 to .89. The adaptation of the survey items replaces the terms "computers" or "technology" with "1:1 technology" and refers to 1:1 classroom integration practices.

The survey also included descriptive data questions, and one question that is an adapted version of The Stages of Adoption of Technology (SA) Survey (Christensen, 1997), which required teacher participants to identify with one of the six stages of technology adoption. The six stages are awareness, learning the process, understanding and application of the process, familiarity and confidence, adaptation to other contexts,

and creative application to new contexts. The Stages of Adoption of Technology instrument is a single item survey; therefore, internal consistency reliability measures cannot be calculated for data gathered through it. A Pearson product-moment correlation was calculated between the two reported Stage measures as a form of test-retest reliability. A high test-retest reliability estimate (.91) was gathered from a sample of 525 K-12 teachers from a metropolitan north Texas public school district during August 1999. The SA Survey item was included on two attitudinal questionnaires completed by educators from a varied span of time from within one hour to the next day, during which the participants never had access to both simultaneously (UNT, 2021). A Pearson product-moment correlation was calculated between the two reported Stage measures as a form of test-retest reliability. The resulting value of .91 indicates high consistency for these educators on reported stages, within the recognized limitations (remembering the contextual cues) that undoubtedly inflated the estimate, compared to a standard reliability index (UNT, 2021). The survey (Appendix A) was digitally distributed during the 2020-2021 school year. It was sent via link directly to faculty members in District Z and also shared with teachers participating in an advanced collegiate educational technology program. The survey included a question through which teachers who were not experienced in teaching within 1:1 environments self-eliminated, thus ensuring that participants had sufficient background to evaluate the experience.

The qualitative interview questions (Appendix B) were adapted from Bauer and Kenton's (2005) Survey Questionnaire for Teachers Using Computer Technology. The teacher interviews allowed the researcher to collect a better understanding of what

influenced the reported perceptions of technology integration from specific teachers (Creswell, 2015). Interviews occurred before and after school to avoid disrupting classroom activities and were recorded using a recorder app on the researcher's phone to aid in the coding and descriptive analysis. Interviews took place in person in a conference room or classroom as agreed upon by the site managers or conducted via Zoom as designated by the participating teachers. The recordings were used to transcribe the data, which also underwent respondent validation to ensure the responses are accurate. This meant allowing participants to review transcripts of their respective interviews for accuracy. The interview consisted of open-ended questions (Appendix B) and asked teachers what influences or impedes their integration of technology. Additional questions asked teachers to assess their personal digital literacy skills and to describe the instructional uses of technology in 1:1 classrooms. Probing for clarification and elucidation occurred as necessary to follow-up on emerging themes. Teachers were recruited based upon their willingness to be interviewed; this was derived from survey responses to item 14. The interview participants represented a range of adoption levels among teachers in 1:1 environments.

Sample & Context

The participants for this research were purposefully selected on the basis of occupation. Participants are secondary teachers working in a 1:1 technology-enhanced school environment. The accessible population from both recruiting avenues was approximately 125 middle and high school teachers employed at suburban, southeastern middle and high schools in District Z. It also included recruiting respondents from a pool of 300 graduate students enrolled in an educational technology program. These

respondents were recruited based upon their employment at middle and high schools that employed 1:1 technology. They were not limited to geography or school size. The sample size was dependent on the survey response rate (Gliner, Morgan, & Leech, 2009). Recruiting a sample that aligns with the study's purpose, its central questions, and the data being sought was vital to the quality of a research study (Patton, 2015). The pool provided an accessible population that allowed the researcher to collect data from individuals willing to "purposefully inform an understanding of the research problem" (Creswell, 2013, p. 156). The study did look for relationships between teacher perceptions and specific characteristics such as self-reported level of integration (LoI), experience with 1:1 as a student, years of teaching experience, level of education, and types of courses taught. The frequencies for these variables are found in Tables 1 and 3 and in Tables C.1, C.2, and C.3 respectively. The sample consisted mainly of highly-educated core subject teachers.

For the interviews, maximum variation sampling investigates the factors influencing technology integration among teachers with similar characteristics. This allowed the researcher to explore differing dimensions to teacher experiences within 1:1 technology-enhanced learning environments. This sampling technique afforded the researcher to explore diverse cases and describe multiple perspectives (Creswell, 2015). With approval from both school administration and IRB, this mixed-methods study analyzed data and identified the common themes derived from secondary teachers' experiences with 1:1 technology integration within 1:1 TEL school districts in the United States. The study evaluated perceptions regarding each participant's course of time in a 1:1 school technology program. Participants were voluntary and came from both District

Z and Educational Technology professionals via different networks. The interview participants reported teaching within the following subject areas: math (n=5), English (n=4), CTE or other electives (n=4), science (n=3), and social studies (n=3).

Participants from the research study work in schools that provide each student with a technological device such as a laptop or tablet. Teachers and students at sampled schools are given access to web-based tools such as the Google for Education suite and to the respective district's learning management system. The school districts represented in the sample offer a range of web-based tools to teachers and students as well as devices for student use in the represented classrooms and content areas. The sampled schools provide wireless access throughout the school and at community hotspots. Participants within this study represent four states in different geographical zones within the U.S. All participants within this group are teachers working within 1:1 school districts, and some are enrolled in a post-secondary educational program.

Data Collection and Analysis

With approval from IRB and school district leaders, the data collection consisted of electronic survey responses and interviews. Surveys (Appendix A) were utilized to acquire descriptives and to identify relationships between independent variables such as 1:1 technology usefulness, ease of use, organizational factors, and teacher characteristics and the dependent variable: teachers' stage of adoption/integration. Additionally, it helped identify current influences and impediments to technology integration. The survey questions and interviews both afforded opportunities for both quantitative and qualitative analysis.

The survey was created and distributed using Qualtrics software. The survey was deployed to the schools' faculty via direct email for the approved District and via link to adult professionals enrolled in an approved post-secondary technology program within the institution's learning management system. The initial paragraph of the survey contained informed consent information and provided participants the opportunity to opt out of participation after reading the introduction. Participants were assured that no identifying information would be included in this research report, and every effort was made to maintain confidentiality as per IRB (Creswell, 2015; Rossman & Rallis, 2017). No participants, institutions, and school districts are named within the reported findings (Cresswell, 2015). Research records were not anonymous, due to the Qualtrics (2017) software collection of IP addresses as respondents submitted their data, but every effort was made to ensure confidentiality to the extent of the law. All data was depersonalized and assigned a random generated user ID to protect the identities of respondents. The research survey began with introductory information explaining the procedures, risks, and benefits of the research. The introduction affirmed that respondents' participation was voluntary and served as informed consent. The recipients of the deployed survey indicated their agreement to participate in the study prior to receiving access to the survey. Participants indicating they did not consent were directed to the end of the survey. The exact wording of informed consent is included in Appendix A as Question 1 of the survey tool.

Data collected throughout the study was kept secure, with all digital files stored on a password-protected computer maintained solely in the researcher's possession (Cresswell, 2013; Cresswell, 2015; Rossman & Rallis, 2017). Only the researcher and

dissertation committee had access to the raw data. All digital files were destroyed upon completion of the research project (Cresswell, 2015; Rossman & Rallis, 2017). The time frame for data collection was approximately 30 days with peak responses being returned within the first week of deployment. Reminder emails were sent to encourage more teachers to respond (Rossman & Rallis, 2017). The survey window was closed based on data provided via Qualtrics analytics; the program indicated when a reasonable span of time had passed during which surveys were no longer being completed. With approval from the dissertation chair, the researcher closed the survey from further responses.

This mixed-method research study analyzed reported teacher perceptions and behaviors when integrating technology within 1:1 technology-enhanced environments. Computer software was utilized in all quantitative data analysis processes for this study. The survey data collected underwent Pearson correlation analysis and descriptive statistics procedures. Statistical information was analyzed using International Business Machines Statistical Package for the Social Sciences (IBM SPSS) software version 27 (IBM, 2020) to determine frequencies and means. The independent variables measured by Likert-style survey questions incorporated categories based on an interval scale (Hatcher, 2013; Levin, Fox, & Forde, 2017). A Pearson correlation was performed to determine the strength of the continuous independent variables' relationships (Hatcher, 2013; Levin, Fox, & Forde, 2017). The strength of the independent variables related to perceived usefulness, perceived ease of use, and organizational factors and the reported teacher stage of technology adoption level were examined to determine what aspects are influencing and/or impeding the implementation of technology and to explore how this affects digital literacies.

The qualitative interviews with voluntary survey participants were then conducted, transcribed, coded, and analyzed. Interviews were conducted primarily one-on-one in classrooms with three conducted via Zoom. The recorded interview was transcribed by the researcher into secure documents that were coded with a series of assigned pseudonyms. The interviews were coded to provide descriptive analysis of responses and discussion of common themes in relation to technology integration, levels of adoption, and to teacher characteristics and perceptions. The interviews were analyzed and coded three times, once for each area of emphasis: barriers to integration, influences to integration, and digital literacies. The first round of coding examined barriers to integration was based upon previous research (Bauer & Kenton, 2005; Ertmer, 1999; Tondeur et al., 2017). These included, but were not limited to, time, training, curriculum, teacher skill, student skill, equipment, etc. The second round of coding focused on finding commonalities among influences to technology integration among the sample. These were annotated for recurring influences participants noted. The third round coded transcripts for digital literacy strands based on Table 1. Additional emergent codes related to all coded topics were added as necessary.

Table 3 Areas of Digital Literacy

Area of Digital Literacy	Description	Citation
Create	Constructing new information and/or integrating prior content and knowledge. Generating information by adapting, applying and designing information in digital environments	Beetham & Sharpe, 2010; Belshaw, 2014; Eshet-Alkalai, 2004; Ferrari, 2012; Hobbs, 2010; ISTE, 2015; Sparks, Katz, & Beile, 2016
Collaborate	Link with others, participate in online networks and communities, interact constructively	Beetham & Sharpe, 2010; Belshaw, 2014; Ferrari, 2012; ISTE, 2015
Think Critically	Identifying digital needs, problem-solving through digital means, assessing and evaluating sources and information	Beetham & Sharpe, 2010; Bekker et al., 2015; Belshaw, 2014; Eshet-Alkalai, 2004; Ferrari, 2012; Green, Yu, & Copeland, 2014; ISTE, 2015; Prior, Mazanov, Meacheam, Heaslip, & Hanson, 2016; Sparks, Katz, & Beile, 2016
Apply Algorithmic & Technical Processes	Identify, locate, access, retrieve, store and organize information; use technology and media to perform tasks through digital tools	Beetham & Sharpe, 2010; Bekker, Bakker, Douma, van der Poel, & Scheltenaar, 2015; Belshaw, 2014; Eshet-Alkalai, 2004; Ferrari, 2012; Hatlevik, 2015; ISTE, 2015
Behave Ethically & Appropriately	Behave in an ethical and responsible way, aware of legal frames, including copyright, and communication through online tools, taking into account privacy, safety, and correct online behavior.	Beetham & Sharpe, 2010; Belshaw, 2014; Eshet-Alkalai, 2004; Ferrari, 2012; Hobbs, 2010; ISTE, 2015

The data from both the survey and the interviews were triangulated to explore teacher technology integration and digital literacies in 1:1 technology-enhanced learning environments. The findings from this process are combined in the combined discussion sections within chapter five.

Chapter Three Summary

Chapter III provided a methodological overview of this research study. The purpose of this study is an effort to explore teacher technology adoption, integration and digital literacy practices. To investigate possible relationships, the researcher collected data through an online survey tool (Appendix A). Descriptive statistics and Pearson correlations were conducted for data related to each research question. Interviews with voluntary survey participants were then conducted, transcribed, coded, and analyzed (Appendix B). The data was analyzed to determine how aspects related to technology integration affect digital literacies and explore what technology integration looks like in 1:1 technology-enhanced classrooms.

CHAPTER FOUR: RESULTS

This mixed-methods study aimed to explore teacher respondents' technology adoption and integration practices in correlation to factors that may present barriers and investigate how this affects digital literacies. The sub-questions were used to identify what influenced and/or impeded technology use and what relationships existed between these aspects and teacher technology integration.

Descriptive Statistics

Data was collected from middle and high school teachers across four states within the U.S.A. to assess teachers' technology adoption levels in relation to factors that influence technology integration and digital literacies. A total number of 53 people volunteered for this study. The total of participants who volunteered for interviews was 19. The quantitative aspects of the survey focused mainly on the dependent variable, Level of Integration (LoI). Survey respondents rated their LoI for their current practice within 1:1 TEL environments. Table 2 presents the Levels of Integration response options and their frequencies. Although 53 teachers completed the survey, only 52 opted to select an LoI. Most respondents (n=23) indicated they see 1:1 as a teaching tool. This aligns with Christensen's Stage of Adoption: Adaptation to other contexts (1997). At this level, respondents are no longer concerned with 1:1 as a technology; they see it as a tool and can use it in many applications to aid instruction. Additionally, 20 respondents (37.7%) aligned with Stage 6: Creative application to new contexts. At this level of integration, respondents are applying what they know. They can easily employ 1:1 technology-based

student activities during class as instructional tools and fully integrate 1:1 technology-based activities into classroom curriculum. 59 The results show that for this study, most respondent teachers were comfortable with 1:1 technology in the classroom. This may have resulted in a biasing effect on the data that was collected.

Table 4 Teacher Levels of Integration Response Frequency

Level of Integration of 1:1	n	%
Awareness	2	3.8
Learning the basics	3	5.7
Beginning to understand	2	3.8
Gaining a sense of confidence	2	3.8
1:1 is a teaching tool	23	43.4
Applying what I know	20	37.7
Total	52	98.2
Missing	1	1.9

Descriptive statistics underwent analysis to examine teacher characteristics including number of years teaching experience, education levels, subjects taught, course levels, experience using 1:1 as a student, and time allotted to using 1:1 in class. The mean number of years teaching experience was approximately sixteen years (M=15.53). Among the 53 respondents, the mode for the number of years teaching experience was 6 (M=6). The mode for the highest level of education attained was 2, which indicated that most respondents held a Master's degree. Respondents who held a Master's degree comprised 49.1% of the participants. Respondents most frequently reported teaching within the following subject areas: English (n=16), math (n=11), 60 other (n=9), science (n=8), and social studies (n=7). Tables C.1 through C.4 in Appendix C list the summary

of descriptive statistics for teacher characteristics. Findings indicated that many respondents had no experience with 1:1 technology in the role of a student. The number of participants reporting having had no experience with 1:1 technology as a student was 35.8% (M=3.6). Conversely, 5.7% of participants indicated that have had a lot of experience as a student in 1:1. Table 4 lists the frequencies of teachers' experience with 1:1 as students.

Table 5 Teachers' Experience with 1:1 Technology as Students

Experience with 1:1 Technology as a Student	*n*	*%*
A great deal	6	11.3
A lot	5	9.4
A moderate amount	9	17.0
A little	14	26.4
None at all	23	35.8

Although the majority of respondents have not had experience with 1:1 as a student, the data points to frequent integration of 1:1 technology in the classroom. Findings indicate that activities involving 1:1 technology are most frequently assigned by respondents every day (32.1%); several indicated three days per week (22.6%) was optimum for 1:1 TEL activities. Similarly, 64.1% of respondents reported they allot half the class or more to 1:1 TEL activities per week (see Tables C.5 and C.6). The descriptive statistics related to teacher perceptions of the 1:1 classroom are found in

Appendix C. Respondents were asked to indicate the level to which they agreed with statements regarding Perceived Ease of Use (PEoU), Perceived Usefulness (PU), and Organizational Factors 61 (OF) in relation to 1:1 classroom. For all items related to PEoU and OF, the highest number of participants indicated they agreed with the statements. (See Tables C.7-C.9). Similarly, teacher participants agreed with all the items related to PU with one exception; respondents highly agreed (n=24) that the 1:1 classroom has allowed them to routinely integrate technology into instruction.

Correlation Data

Pearson correlations were conducted to determine if relationships existed between LoI and PEoU, PU, OF, and teacher characteristics. There were moderate negative correlations between four of eight variables related to PEoU and LoI (see Table 5).

Table 6 Pearson Correlation LoI to PEoU

Correlation LoI & Perceived Ease of Use of 1:1 Classroom	Pearson Correlation
Level of Integration Chosen	1
I know how to meaningfully integrate the use of the technology into my classroom lesson plans.	-.403**
I can align the 1:1 activities with my district's standards-based curriculum.	-.189
I have received adequate training to incorporate it into my instruction.	
My digital literacy / technology skills are adequate to conduct classes involving it.	-.261
Most of our 1:1 devices are kept in good working condition.	-.419**
I can readily obtain answers to technology-related questions.	-.360**
My students have adequate access to up-to-date technology resources.	.032
	-.397**
Materials (e.g., applications, printer, supplies, etc.) for classroom use of 1:1 technology are readily available.	-.220

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Similarly, five of seven PU-related variables showed significant moderate negative correlations to LoI at the 0.01 level, and one variable had a high negative correlation (see Table 6).

Table 7 Pearson Correlation LoI to PU

Correlation LoI & Perceived Usefulness of 1:1 Classroom	Pearson Correlation
Level of Integration Chosen	1
Has made my teaching more student-centered and less lecture-based	-.363**
Has allowed me to routinely integrate technology into my instruction	
Has changed my classroom's learning activities in a positive way.	-.603**
Allows my students' learning activities to be more interactive and collaborative.	
Has increased the overall level of student interaction and/or collaboration.	-.479**
Has positively impacted student learning and achievement.	-.331*
Has improved the quality of my students' work.	-.383**
	-.355**
	-.262

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 7 denotes that three variables related to OF show moderate negative correlation to LoI. All three of these factors are related to support from outside entities including the community, teachers, and school administration.

Table 8 Pearson Correlation LoI to OF

Correlation LoI & Organizational Factors	Pearson Correlation
Level of Integration Chosen	1
Parents/caregivers support our school's 1:1 technology program.	-.253
Community members support our school's 1:1 technology program.	-.344*
Our school has a well-developed technology plan that guides all technology integration efforts.	-.174
Teachers in this school are generally supportive of the 1:1 technology program.	-.376**
School administrators support the integration of 1:1 technology into classroom practices.	-.387**

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Lastly, a Pearson correlation was executed between LoI and teacher characteristics. There was a low positive correlation at the 0.05 level between LoI and teacher education (Table 8).

Table 9 Pearson Correlation LoI to Teacher Characteristics

Correlation LoI & Teacher Characteristics	Pearson Correlation
Level of Integration Chosen	1
Total years of Teaching Experience	-.207
Experience as a Student with technology-enhanced classwork	.129
Level of Education	.275*
Type of Course Taught	-.216

*. Correlation is significant at the 0.05 level (2-tailed).

Digital Literacy Skills

Survey data in Table 9 shows the types of digital literacy (DL) behaviors students in participants' (N=53) classes were focused on by DL strand. More than half (54.7%) of respondents indicated their students worked to create knowledge (DL 1). This was followed most closely by DL strand 2: Collaboration (30.2%). Critical thinking and technical processes accounted for approximately 6-8% with ethical behaviors being the most limited focus.

Table 10 Types of Digital Literacy Behaviors Being Worked on by Students

Types of Digital Literacy Behaviors Being Worked On	n	%
DL 1: Creating knowledge	29	54.7
DL 2: Collaboration	16	30.2
DL 3: Critical Thinking Skills	4	7.5
DL 4: Identifying, locating, accessing, retrieving, storing, and organizing information (technical processes)	3	5.7
DL 5: Behaving online, and with respect to electronic information and communication, in an ethical and responsible way	1	1.9
Total	**53**	**100.0**

Upon indicating that a digital literacy area was being worked on by students, participants were prompted to share technology tools they utilized to support these skills, which are compiled in Table 10. Tools that were mentioned by multiple participants within one area are listed only once, but tools listed in support of other areas may be denoted multiple times. Participants shared that the use of Learning Managements Systems and cloud-based web tools were beneficial at helping students practice across all five digital literacy strands. Other tools were web-based tools allowing for classroom management or content specific activities, games, and/or lessons. A total count of responses by the digital literacy area suggests a greater focus on digital literacy in the classroom. Respondents shared the following number of tools and/or activities for each area of digital literacy: DL 1 (n=29), DL 2 (n= 34), DL 3 (n=27), DL 4 (n=36), and DL 5 (n=17).

Table 11 Teacher Listed Technology Tools by Digital Literacy Areas

Digital Literacy Area	Skill(s)	Technology Tools
DL 1	Create	Virtual Library, Microsoft 365, Kahoot, Nearpod, Gimkit, Desmos, Geogebra YouTube, LMS (e.g., Schoology), 3D software
DL 2	Collaborate	LMS (e.g., Schoology), Google Classroom, Google Drive, Google Slides, Google Docs, Kahoot, Quizlet, Microsoft OneNote, Edu blog, Flipgrid, Padlet, Actively Learn
DL 3	Critical Thinking	Virtual Library, Desmos, Geogebra, NewsELA, Digital spreadsheet data analysis, Edpuzzles, IXL, No Red Ink, Actively Learn
DL 4	Identify, Access Information, & Technological Processes	Google Drive, Google Docs, One Drive, Google Classroom, No Red Ink, NewsELA, Virtual Library, Seesaw, Internet research, LMS (e.g., Schoology)
DL 5	Ethical Behavior	LMS (e.g., Schoology), Turnitin, Class Dojo, Digital Citizenship courses, Google Suite, Common Sense Media

Interview Descriptives & Data

Nineteen survey respondents volunteered for the qualitative interview portion of this study. Of the total participants in this stage, sixteen participants identified as high school teachers in grades 9-12, and three teach middle grades 6-8. Respondents most frequently reported teaching within the following subject areas: math (n=5), English (n=4), CTE or other electives (n=4), science (n=3), and social studies (n=3). Eleven interviewees indicated that their content, district, and/or state did require the use of technology, two noted that it did not mandate it, and six said that although it was not required specifically, it is "highly encouraged."

Digital Literacy Focus in the Classroom

Upon final coding of interview transcripts for digital literacy areas (see Table 1), teacher responses indicate the main area of focus is on applying algorithmic and technical processes (DL 4); it was mentioned 34 times among nineteen respondents. Areas focused on creating, collaborating, and thinking critically followed closely behind with 11, 10, and 11 mentions respectively. Only three interviews mentioned DL 5, implying a need for student practice in the ethical and appropriate behavior when using technology. Multiple uses of technology discussed within the interviews straddled two or more areas of digital literacy. Teachers in the interview phase utilize 1:1 technologies for the following: create presentations and videos (DL 1/2), 67 research projects (DL 3/4), class communications (DL 2/4), learning management systems (DL 4/5), accessing information from home for absent/quarantined students (DL 2/4/5), data processing (DL1/2/4), data analysis (DL 3/4), lesson planning in Google Suite (DL 2/4), managing

calendars and meetings (DL 2/4), online websites and tools (DL 4), Seesaw to document and communicate (DL 4/5), and interactive discussion posts (DL 2/5).

Influences on Teacher Technology Integration

Interview participants were asked the open-ended question: "What factors influence your decision to integrate 1:1 TEL activities in your instruction?" All nineteen participants shared 1-3 responses noting what influenced their decisions to utilize 1:1 TEL. The majority of influences discussed were related to perceived ease of use and usefulness of technology. Only one influence given was related to an organizational factor: forced migration. This means that outside factors compelled participants to use technology since previous resources were no longer available or accessible. A few participants noted that it was a necessity to integrate devices given that physical textbooks were no longer being adopted and purchased and 1:1 devices were adopted district wide. During second round of coding, recurring influences to technology integration among the sample emerged and were coded for analysis. Themes among influences that were repeated by multiple participants and elaborated upon are ease of use, personal experience and digital literacy skills, and student maturity and digital literacy levels.

Ease of Use

Mark stated, "There has to be ease of use. If it's not easy to use, then we don't want to use it. Technology should be, I've always thought technology should be easy to use; if it's not easy to use, then we'll do it the old school way." Within the context of the interviews, ease of use was equated with making the teaching and learning processes more efficient, engaging, and accommodating. Participants noted 1:1 TEL has been

convenient. They did not have to waste paper with copies or deal with outdated information in old textbooks. The 1:1 made learning the material more engaging with the ability to obtain instant feedback and make lessons fun through the variety of activities available that aligned with curriculum and technology standards. It was noted that technology does capture student interest, but it was most influential when it was as "real world" as possible. Teachers repeatedly noted that the ease of scaffolding lessons and differentiating materials to meet student needs was also an influence. It was further noted by Amy: "It's been a wonderful tool with COVID because I've been able to post videos of instruction. I've been able to open up Zoom[calls], and the kids use their devices at home if they're absent. And this has sort of bled over into just normal absences. I'll have a kid who's absent and who will say, 'Can you zoom today's lesson? So, I don't miss what's going on in the classroom.' Now, do I always love doing that every day? No, but it has been very effective…You've got to do any and everything to engage your students, and you got to keep up with what's going on in this day and time; from their cell phone to their Macbook, to their iPad, that's their normal life. So, you've got to figure out how to use it effectively."

Personal DL Skills, Knowledge, and Experience

Half of the interviewees shared that their personal knowledge and experience with technology and digital literacy skills influence their integration of 1:1 TEL. Several have been using technology since middle school, high school, and college and do not feel intimidated by using it or in trying new applications in the classroom. Their fluency derives from practice and experience. Two participants discussed that their experience and skill has reinforced their abilities to seek out information when it is new or

unfamiliar. Laura said, “I’m definitely competent, and if I don't know how to do something, then I can figure it out. I know enough to be able to teach rudimentary technology skills to students for the purposes of my classroom.” Emily similarly elaborated on this idea by saying, “…if I want to learn how to do something new, all I have to do is go on YouTube and watch a video one time, and then I'm pretty good and pretty set on how to use it and implement it.” Alternatively, some noted that their knowledge level at troubleshooting and resolving issues influenced 1:1 TEL use. They want to avoid loss of instructional time. When participants experienced technology-related issues that were not efficiently solved, participants said it negatively impacted their frequency in integrating in.

Student Maturity & Digital Literacy Levels

This theme emerged in relation to the time it may take to teach and set-up technology protocols in the classroom as well as ability to focus on a technology-related task. Often, participants noted that if a technology tool was useful on a regular basis, then this time investment was worth the integration. Emily mentioned this influence was “whether or not they[students] know how to use something[technology-related] or if they have to be taught how to use it first.” To ensure success, Emily continued…” so we'll model and go through it [tech process] with them and then gradually release them to be able to do it on their own.” Other participants added that students are not all working at the same digital skill level and flexibility was necessary to implement 1:1 TEL in students’ education. Laura was concerned with “the maturity level of the students” in relation to their ability and willingness to stay on-task and complete the assigned

activities. Some participants felt that maturity and student skills had to be evaluated to determine if TEL activities were more effective than paper and pencil.

Barriers to Technology Integration in 1:1

The adoption of 1:1 devices has eliminated several of the 1st order barriers such as access and resources; however, barriers still persist, even among 1:1 TEL environments. (Tondeur, van Braak, Ertmer, & Ottenbreit-Leftwich, 2017). In exploring technology integration and the aspects that impact digital literacies, interviewees were directly asked to discuss obstacles they had to overcome to use 1:1 technology in their respective classrooms. The coding process involved examining the barriers to integration, which were based upon previous research (Bauer & Kenton, 2005; Ertmer, 1999; Tondeur et al., 2017). These included, but were not limited to, time, training, curriculum, teacher skill, student skill, equipment, etc. Participants frequently shared similar issues connected to knowledge and/or time. Barriers emerging from the interviews are as follows: lack of knowledge and/or training, change of devices/platforms/LMS, time: prep work and troubleshooting, lack of IT support, time: speed of evolution of technology, and management of technology/distractions.

Lack of Knowledge and/or Training

Participants mentioned that one obstacle to 1:1 technology integration was a lack of knowledge and/or training to do so effectively. Despite teaching in 1:1 classrooms in previous years, the past year forced multiple teachers to utilize technology for distance learning during the COVID pandemic. Teachers with limited technology training were "not comfortable" and felt they were "not fluent enough to use with students (Nora, Matthew). Matthew stated that "in some ways, I am innovating where I have to, but it's

kind of mostly only where I have to, because I don't have a lot of support to do that beyond what I jumped out and decided to do on my own." This obstacle was also mentioned in relation to digital literacies in the classroom. Teacher participants discussed how students come in with different levels of proficiency, and it "can be hard to manage" "to teach students and make sure they know how to use them[devices]" on top of content (Nora, Diane).

Change of Devices /Platforms/LMS

More than half of participants indicated a major obstacle was the organizational change related to adopting different devices, platforms, and/or learning management systems. Organizational adoption thrusts teachers into the integration stage (Rogers, 2005), often with little input or knowledge of the matter. Though the decision to adopt the devices was made by district stakeholders, the teachers must then learn the innovation and then implement (or ignore) it. Participants felt such a major change was a huge hurdle because it required rearrangement of teacher thought and processes related to technology. Teachers noted they had to spend time revising current activities and sometimes replacing ones that were not compatible anymore. Some content areas utilized lab tools and software that was integrated and useful, but the equipment was no longer compatible with the new devices and/or platforms. "I'll have to learn all over again," noted Sandra; similarly, Laura indicated it required re-evaluation of "how I have students use their technology…. when, for what purpose, that type of thing." Teachers who indicated that a lack of knowledge was an obstacle also felt this compounded the issue. Additionally, interview data in this area noted the change is challenging for students as well. Vera stated," I would say sometimes students not, you know, not buying in or them

not seeing the value in practicing using the different media or the different style, getting them to be okay with being uncomfortable" is an obstacle. One participant flatly noted that "they[students] haven't adapted well from a MacBook to an iPad."

TIME: Prep work & Troubleshooting

Several teachers noted that the time required to prepare activities for class was an obstacle. This aspect was two-fold. First, teachers must prepare and create the technology-enhanced learning activity with the device, tool, or website, and then they must, in-turn, teach the students how to access and complete it. Creation of online materials and activities requires time and knowledge. Participants questioned if all the time upfront is worth it to integrate 1:1 technology versus traditional methods, especially when some participants "do not pick up on new and different programs" (Brenda). The other aspect to this obstacle is time spent troubleshooting when integration is happening. Often, participants indicated that much prep and practice with technology occurs at home, but sometimes troubleshooting issues do not occur until network safety protocols interfere on campus, which can add a layer of difficulty in trying new technology-enhanced tools and activities for students. "If you're using a lot of different types of technology, it can make it difficult and more time consuming, and you'll run into issues that you normally wouldn't run into. And that's very frustrating," posited Mark. Ashley posed the complexity of integrating, teaching, and troubleshooting: "now, not only am I trying to integrate lessons with technology, I am a problem solver for technology that takes a lot of classroom time." It was clear that technology was important and useful in the participants' classrooms, but troubleshooting consumes valuable time and sometimes necessitates a different lesson when it cannot be solved in a timely manner.

Lack of IT Support

One-third of interviewees shared that a lack of IT support was an obstacle to integration (Nora, Mark, Emily, Jennifer, Ashley, Susan). Participants note that although they have become quite good at utilizing Google and YouTube to troubleshoot issues, it would be helpful if there were on-campus staff dedicated to streamlining the process. If a piece of equipment malfunctions, the teacher must either submit a help ticket and wait, or he/she must troubleshoot it. Participants report this process is "tedious" and "takes more time than it should" (Mark, Sophia).

TIME: Speed of the Evolution of Technology

The sheer speed at which technology evolves and changes poses an obstacle for teachers both new and seasoned to 1:1 technology integration. Mark stated, "I've been teaching for 15 years and there's been a very, very fast paced change, uh, as far as integrating different hardware and software technologies in the classroom. So just the sheer number of software and hardware that teachers must learn now is, is hard. It's very stressful." This fast pace prompted Diane to admit "I'm always trying to keep up…I like to learn about the programs… but it seems like it moves so quickly. As soon as you get through one program, they've developed another area that you could go into. And so, it developed so fast, it just goes so quickly that it's really hard to keep up." Moreover, participants indicated that technology integration is something that is never finished. It is perpetually changing and updating, and to continue to keep content TEL activities engaging and interactive, it takes time. Sophia said, "it's [technology integration] not something that's ever done. You know, you, you're always working toward making your online content as engaging and interactive as possible. So, I definitely consider myself an

innovator in that way. But I think everybody needs help with that. Noone's ever an expert because it's always changing. So, it's nearly impossible to stay up to date." The pace with which technology tools, sites, and devices become available causes some teachers to question if the latest trend is worth the hype or time required to make the change to class activities and content. Dawn shared that it was preferable to stick to what one knows rather than try the latest, unless it seemed to be a lasting change: "If there was a new, um, technology that came out, I'm not immediately going to catch on to it, but if other people are using it and I realize it's going to be something that sticks, then I can learn it pretty quickly. Um, but I, most of the time, just stick to what I know." Overall, the rate at which technology changes causes participants stress including the amount of time it takes to learn the new device, tool, or site and share this knowledge with students. Brenda summed it up: "the obstacle is just always the overabundance, overwhelming amount of programs and apps that are out there now, which ones are what you want along with the new...just having to relearn what you do every year to present. I don't know if that makes sense. It's like, there's so much out there, but then there's this constant change on top of doing everything you can. It takes time to vet everything. It takes time for me to learn every time." It was clearly a major obstacle for the majority of participants working in 1:1 environments.

Management of Technology/Distractions

The 1:1 classroom presents an obstacle to teachers in the area of classroom management. Six participants noted this required time and attention for learning how to "enforce and/or regulate student technology use". Sometimes class size makes this difficult; Hannah said, "There's usually one of me and 30 students. So, keeping them all

on the correct task at all times, it's kind of a weighing the risks and the benefits process." Students were reported to exhibit off-task behaviors which required teachers to "switch up classroom management" to alleviate that. Teachers seem more than willing to integrate 1:1 TEL when it can be readily managed; if not, they prefer to utilize traditional methods of learning. Similarly, participants reported students left devices at home and/or forgot to charge the devices. This may create obstacles in executing the planned lessons. Dawn shared an experience where "you prepare this lesson for everybody who has iPads, and then you'll have three come in that day who don't. So, you're having to do something different or, you know, they're having to work with a partner, and you hadn't originally planned for that; you know, you wanted it to be individual work, so that's been an obstacle." This can also lead to off-task behaviors and distractions related to collaborative learning.

Chapter Four Summary

Chapter IV provided a comprehensive overview of the data from both the quantitative and qualitative phases of this mixed-methods study. The quantitative phase was presented using descriptive statistics, Pearson correlation data, and digital literacy data from the survey. Correlations examined are among teacher levels of integration and PEoU, PU, OF, and teacher characteristics. The qualitative phase was presented using descriptive data related to the influences and barriers teachers experiences when integrating technology in 1:1 educational environments. Influences are ease of use, personal experience and digital literacy skills, and student maturity and digital literacy levels. Barriers are lack of knowledge and/or trainings, change of devices/platforms/LMS, time: prep work and troubleshooting, lack of IT support, time:

speed of evolution of technology, and management of technology/distractions. The data provided within the chapter's tables and interview themes will be addressed and support the implications and recommendations in chapters V and VI.

CHAPTER FIVE: DISCUSSION

Although 1:1 technology and digital literacy standards are increasingly adopted in U.S. School districts, presence alone cannot guarantee integration practices within such organizations (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Rogers, 2005; Vongkulluksn, Xie, & Bowman, 2018). Educational stakeholders and teachers can address this issue by examining the integration practices within their respective systems. The purpose of this mixed-methods study was to explore teacher technology adoption, integration and digital literacy practices.

In this chapter, the results of this study are discussed in further detail and connected to literature relating to 1:1 technology integration and digital literacies. This will allow for the exploration of the implications of teacher technology integration practices within secondary 1:1 TEL environments and how these aspects affect digital literacies. It allows for suggestions to be made about supporting teachers in their integration of technology and digital literacy instruction within 1:1 classrooms.

Research Question One

The first research question asked: How do aspects related to technology use affect digital literacies? To answer this, it is necessary to address the two sub-questions related to teacher technology integration and then discuss how the components collectively affect how digital literacies are perceived and practiced in the 1:1 classroom.

Sub-Question 1

Sub-question one asked what influences or impedes teachers' use of technology within classroom instruction. The rate of adoption (Rogers, 2005) notes that people respond to innovations at different rates. Adoption groups vary in speed when undertaking a new product such as 1:1 technologies. This study's findings align with this theory; 81% of participants reported their current practice is in the more advanced level of integration. Rogers (2005) also notes that adopters' attitudes towards an innovation are formulated from personal perceptions of relative advantage and its complexity. These aspects align with the Technology Acceptance Model's components of perceived ease of use and perceived usefulness.

Within the survey, 32.1% of respondents assigned 1:1 technology-enhanced activities in class every day and 18.9% assigned them in class 4 days per week. While this indicates frequent use of technology in the respective classes, 18.9% responded that they only assigned 1:1 TEL activities in class once per week (see Table C.6). Similarly, when participants were asked what portion of class was allotted to 1:1, the 64.7% noted they spent half the class or more on 1:1 TEL activities (see Table C.5). These frequencies do show that teachers are implementing technology into their courses. Although, time spent on activities may not solely be a strong indicator to how successful class activities were in achieving the learning targets and practicing digital literacies.

It is necessary to analyze the qualitative responses related to teachers' influences and impediments to using technology in class instruction. Previous research (Bauer & Kenton, 2005; Ertmer et al., 2012) indicated that teachers wanted to use technology, but access to devices was a major barrier to integration. While the adoption of 1:1 devices

has removed this hurdle from the past, other barriers from research remain: time and knowledge-related issues. During the interview phase of this study, the teacher respondents indicated three major influences and six major barriers that affected their decision to integrate 1:1 TEL activities. The major influences elaborated upon were ease of use, personal experience and digital literacy skills, and student maturity and digital literacy levels. The barriers were lack of knowledge/training, change of device/platform/LMS, time for prep work and troubleshooting, lack of IT support, speed of the evolution of technology, and management of technology. On some level, these influences and barriers are derivative of past findings.

Time and knowledge were running themes among both influences and barriers in this study. Participants noted that if the technology was easy to use, then it was integrated often; in contrast, when the prep work or troubleshooting required to use technology was time consuming, it posed a major barrier to integration, which was further compounded by a lack of IT support in some cases. Teachers favored traditional methods over the loss of instructional time; however, this limits students' exposure to digital literacies in class. Additionally, the management of devices was related to time as it required teachers to devote more time and attention to regulate student technology use, especially in larger classes.

The major barrier related to time was the speed at which technology changes. This barrier, though related to time, heavily impacted knowledge. Respondents noted that the fast pace by which technology changes kept instructors in a perpetual state of "trying to keep up." Mastery felt elusive, so some educators questioned the time required to redevelop technology related activities. This, in turn, limits opportunities for students to

practice their skills. Hall (2010) posited that regardless of access, the extent of use by teachers varies dramatically. It is this use and non-use of technology across classrooms that is perpetuating gaps in students' use of technology. Some teachers who indicated they felt knowledgeable about integrating technology noted that their technology use was influenced by the maturity levels of the students, which varied by class. This aspect was related to time as well since groups deemed less mature exhibited off-task behaviors, which requires more management and time redirection.

Sub-question 2

The second sub-question asked: Is there a relationship between teacher opinions of technology and organizational factors, perceived usefulness, and ease of use? Tables C.7, C.8. and C.9 list the frequencies of teacher responses for each survey statement related to PEoU, OF, and PU. The majority of teacher survey participants overwhelmingly agree with all of the statements related to the 1:1 classroom and perceived ease of use, organizational factors, and perceived usefulness. Yet, the Pearson correlation tests run between teacher-selected levels of integration and variables related to PEoU, OF, and PU were negative for several variables.

PEoU variables with negative correlations to levels of integration noted that teachers know how to meaningfully integrate technology into lessons and have adequate digital literacy skills to conduct class, students have access to up-to-date resources, and the devices are in good working order. Although educators indicated higher levels of integration skill and primarily view technology as a tool, this does not guarantee integration or translation into current classroom practices. Past research (Ertmer et al., 2014; Sahin et al., 2016) found that teachers' experience may not be a positive

contributor to technology integration. They face challenges with change despite access to technology and perceived ease of use. While the access to up-to-date resources and working devices eliminates first-order barriers such as adequate access, the time and knowledge necessary to prepare lessons utilizing technology and execute them into the classroom proved challenging to participants. Moreover, participants may have the skills and training to personally use technology, but this does not account for student skill. Participants noted that often students lacked digital literacies and technology-related skills, which negatively impacted the planned in-class activities. Teachers' may be well-versed in how to teach their content area knowledge, but the translation of technology-related content may be a different matter. The change in devices and/or platforms mentioned in the interview phase brought about concerns related to ease of use. It was noted by Pamela that "the iPad themselves are an issue because they just don't do as much as the laptop. So, a lot of the things we did before, like using Padlet [application] or whatever other tool, that is super easy on a laptop, is not easy on an iPad. I forget this, and so I'll say [to my students],' this is so easy to go to Padlet and type [topic] in,' and it doesn't work." The device may be perceived as easy to use, but the differences in functionality across platforms is not as lateral of a change, which impacts integration. These concerns challenged experienced teachers' pedagogy across their time within 1:1 environments, which, at times, caused teachers to choose traditional lesson methods over technology to be more efficient and productive in addressing curriculum standards.

For every variable related to organizational factors, 73% or more of the 53 survey participants positively agreed that parents, community members, teachers, and school administrators support the school's 1:1 technology program. However, only 62% of

respondents indicated they agreed that the school has a well-developed technology plan (see Table C.8). Although statements related to support from the community, teachers, and administration showed agreement that organization support is present, these variables negatively correlated with teachers' selected LoI. Given the micro and macrosystems within an organization such as a school system, the degree to which support is given varies. Participants agreed that they felt the 1:1 programs in their respective districts were supportive of technology implementation, but the act of integration varies by individual and context. Within Rogers' Five Stages in the Innovation Process in an Organization (2005), adoption of devices is a decision made by stakeholders outside of the classroom contexts within which the implementation must take place. The organization clearly supports the adoption of 1:1 technology among classrooms, but in what ways are educators being supported in the implementation phase? Training provided to teachers is available, but large professional development sessions may be too broad to effectively help educators find useful ways in which to integrate it. Sahin et al. (2016) found that often teachers were provided training on what tools were available to use but not how to implement them in their respective grade levels and/or content areas. Although the organizational support is present for 1:1 programs, differentiated supports are necessary to address gaps between technology and pedagogy.

Perceived usefulness was another area in which participants' survey opinions indicated agreement for the variable statements. At least 50% of respondents indicated they agreed that the 1:1 classroom is useful for each statement related to perceived usefulness (PU). The areas with the highest percentage of agreement were in allowing teachers to routinely integrate technology, in allowing activities to be more interactive

and collaborative, and in changing learning activities in a positive way. Numbers were much lower relating the usefulness of 1:1 classrooms to making teaching more student-centered, increasing student learning and achievement, and in improving the quality of student work. Moreover, almost every statement related to perceived usefulness negatively correlated with teachers' LoI. Sahin et al. (2016) found that teachers developed negative attitudes towards technology use after teaching in a 1:1 environment for a year. They found that inadequate training, support, and policies affected these attitudes. Interview findings from this study supported this as respondents mentioned inconsistencies in policy, usage, devices, and training. Teaching with 1:1 devices required different skill sets and pedagogies for which they had not been trained and devices with which they were unfamiliar or did not know how to manage.

There was also strong concern for student learning. Teacher interviewees indicated they were concerned that students in 1:1 environments were exhibiting off-task and academically dishonest behaviors. "Copying and pasting" and "Googling answers" are much more prevalent. Pamela responded that "one-to-one made the kids less creative" because when making posters, students "would just Google [subject] posters and copy what they saw instead of thinking it out. And so that was something I hadn't anticipated, I guess. And even now they tend to trace over their screen instead of sketching something themselves. I think they're trying to be perfect. And I'm not looking for perfect. I'm looking for authentic, I guess, genuine, organic…" There was also the concern that students' appreciation for knowledge seems lower. Sandra noted: "students don't have a background knowledge that you would expect from them. They don't seem to have that curiosity because they never had the learn to seek information; it's already just right there

for them. So, they don't appreciate knowledge, you know, why should they remember anything because it's all just right there for them to find? A lot of times I find that students in my generation were more intellectually curious than the students who are used to that." Overall, teachers do perceive 1:1 technologies as useful, but there are still obstacles and concerns to be addressed in implementing them in the classroom. Respondents felt that since devices had been purchased for the classroom, there is an expectation of use, but they worried about technology being implemented simply for the sake of technology. Mark noted, "[schools} invested money into this technology. They want to see the kids on the devices at all times. And I don't know if that's necessarily the best thing to expect. I think technology should be used as a tool. And just because you're on the computer or the iPad or whatever device it might be, doesn't mean that you're really good or the student is getting anything out of it. It's just a tool, just like anything else. Technology doesn't equal rigor." Participants felt very strongly about student learning, but they sometimes felt that implementing technology took time and practice that may not have the same learning outcomes as more traditional ways of learning similar material.

RQ 1 Combined Discussion

Overall, participants in this study noted personal experiences and digital literacy skills, ease of use, and teacher opinions influenced their technology integration. Alternatively, respondents noted that barriers were heavily related to time and knowledge. They struggled with a lack of training and knowledge pertaining to how to integrate it meaningfully into their courses, changes in devices/platforms, and the evolution of technology in the classroom. Participants were mostly agreeable that 1:1

classrooms are perceived as easy to use and useful and that their respective organization supported technology use. Still, there appears to be a negative relationship between perception of the devices in the classroom and the reality of integration among these aspects. Part of this negativity was due to abrupt and tumultuous shifts in technology-enhanced learning over the past year. The COVID-19 pandemic forced many school districts to utilize online and blended learning, causing teachers to shift instructional delivery to integrate more technology or design a completely online curriculum. The limitations of time, access, and training for this type of instruction added stressors to traditional classroom teachers, and students, who were unprepared for such abrupt change. In addition, some participants were experiencing change within their respective organizations as new devices and learning platforms were adopted.

The frequent changes in devices and platforms poses difficulties for educators trying to not only teach content but digital literacies. First, the time necessary to navigate technology integration in the curriculum is more than most educators are allotted to plan during the school day, which can be stressful. Once the activities had been created and vetted, educators appeared to be pleased with the outcomes of 1:1 classrooms, but attitudes reflected change right along with systemic changes. Some participants had mentioned their love for integrating technology into classroom activities prior to recent changes in devices and platforms. Their positivity towards TEL learning became stifled when the activities, lessons, and tools they had worked so hard to create and promote digital literacies among students became defunct and/or less effective with the adopted changes.

Sahin et al. (2016) found that teachers' experience may not positively contribute to technology integration. Some educators are resistant to change because planning curriculum takes time, and adding and/or changing technology tools presents further challenges to the educational environment. The participants of this study reported high levels of integration. They see technology as a tool. Research indicates teachers' confidence and knowledge of technology are important to the technology-enhanced classroom (Christensen, 2002; Ertmer et al., 2014; Kopcha, Neumann, Ottenbreit-Leftwich, & Pitman, 2020, Sahin et al., 2016); we must not only understand what resources are available but also how and why teachers use those resources. Sahin et al. (2016) notes that previous research in the 1990s found that teachers do not use technology effectively in teaching at the beginning of their careers, and it takes more than five years to become comfortable with computer use. Theoretically, given enough time, teacher technology integration could be powerful and innovative. However, this does not account for the diverse teacher (knowledge, pedagogy, teaching style, beliefs) and contextual (support, organizational structure, school culture) components that affect such a change (Ertmer et al., 2014; Tondeur, Devos, Van Houtte, Van Braak, & Valcke, 2009) The mean years of teaching experience at respondents' current schools was 8. Interviewees among all the sample sites discussed device/platform changes as a barrier. This supports past findings. If it takes five years to adapt to a new device/platform, then this perpetual evolution in technology remains problematic, especially when digital literacies are a growing emphasis in education. Although newer teachers and teacher education programs are experiencing more technology integration as students and are

learning to use it in classrooms, the issue with time and rate of change among technology remains.

Teachers' opinions of technology do show a mixed relationship in perceived ease of use, usefulness, and organizational factors. In this study, these variables negatively correlated with teacher LoI. This is possibly related to the speed of technological change in education. Educational stakeholders must take care to ensure that there is sufficient instructional support for educators when a technological adoption occurs. The Consortium for School Networking's annual report for K-12 innovation lists the evolution of teaching and learning as one of the top five hurdles for 2020. With more emphasis being placed on digital literacies as a component to student learning, it is imperative for research to address this hurdle. The report states, "As teaching, learning, and learning outcomes are constantly being redefined, schools are tasked with ensuring that teaching practices and pedagogies are not outpaced by technology trends, nor by advances in our knowledge of how people learn" (CoSN, 2020). Digital literacies in the classroom depend upon the degree to which opportunities are given to support these skills, but this does not happen without meaningful and regular integration.

Survey data indicates that teachers are working on most digital literacy categories. According to survey data, digital literacy behaviors most commonly being worked on are creating knowledge (N=29) and collaboration (N=16). Some participants did indicate they were working on critical thinking (N=4), accessing information and technical processes (N=3), and ethical behaviors online (N=1). These lower numbers for DL 3, DL 4, and DL 5 could potentially be attributed to teacher comfort with the current devices and/or platforms. The data from the interviews indicated that the change in platforms and

devices created a barrier to integration. Teachers and students alike had to adjust to the different functionalities and features available. Some teachers reported that 1:1 TEL activities take time to develop, and that often the change of device and/or platform may cause an entire tool, application, website, or equipment to become useless or lose partial functionality. This was admittedly very "stressful" and "frustrating" for teachers who had spent countless hours curating content and designing technology-based activities for a particular platform or learning management system.

The most widely addressed digital literacy area was creating knowledge and collaboration. These are important building blocks to other areas of digital literacy such as critical thinking, accessing information and technical processes, and ethical behaviors. The digital literacy area of identifying, locating, and accessing information through technology was of low focus according to survey data. Only 1.9% of survey participants said it was a behavior of emphasis. This is possibly because current students have grown up in a digital landscape where Internet access and devices are replete and commonplace. Both teachers and students are using technology to search and access information daily, thus it has become embedded in 1:1 environments. Another area of limited focus was behaving in ethical and responsible ways and communication through online tools, which had the lowest rates of focus, yet among interviews, it was one of the greatest concerns among participants. This poses a paradoxical challenge to integrating technology and digital literacies. Some participants posited that unethical behaviors such as cheating, distractions, and online bullying caused them to limit such interactions with technology. But, if students are not given opportunities to practice ethical online behaviors, then how does this practice become a habit? Survey data shows that teachers indicate ethical

behaviors are being managed through digital tools such as plagiarism detection and learning management system features. While this does control some teacher concerns related to ethical and responsible technology use, it does not necessarily equate to a direct focus on proper decorum. Knowing this, educators may want to consider ways in which students are given opportunities to demonstrate their knowledge of ethical online behaviors before omitting technology-related activities altogether. The data indicated a need for emphasis on DL areas related to critical thinking and ethical behaviors. It was evident that opportunities to access and find information were plentiful. Perhaps, there are ways in which students may be given tasks to think critically about how this ease of access is directly tied to ethical issues and then problem-solve ways to address the issues. Nevertheless, if integration is not valued by the classroom teacher, students' exposure to digital literacies in context is limited. If we want students to value and exhibit digital literacies successfully, then educators must model these desirable 21st-century skills. It cannot be assumed that students will connect the mere presence of technology and its use to digital literacies without proper guidance.

One-to-one TEL positions teachers and students ahead of the first-order access barrier, but how much farther? This will most likely be dependent upon the rate of change of innovation within an organization. The adoption of up-to-date devices is a perceived useful aspect of 1:1 devices; however, such change can set back integration levels in classrooms, shifting the dynamics of teaching and learning with technology, attitudes of its users, and skills required to promote digital literacies. Set-backs such as abrupt changes in technology impact its integration levels. If it is not integrated, then this limits students' exposure to direct digital literacy instruction. If it is integrated, the depth and

breadth to which digital literacies are addressed across courses still vary. Over time, this may create instructional gaps where student digital literacies are concerned. Data from this study and past research all point to the importance of time in planning, training, and practicing to gaining digital literacies for both educators as well as students. Students' digital literacy practices are modeled from their examples. It is imperative that despite changes and time constraints, educators make meaningful technology-enhanced lessons emphasizing digital literacies routine to see this emulated by students.

Research Question Two

The second research question asked: What does teacher integration of 1:1 technology look like? To further delve into this scenario, the sub-question examines if there are similarities in teachers' stages of integration and teacher characteristics? (i.e., years of experience, content areas)

Teacher integration of 1:1 technology varies in context and content. Within this study, 81% of survey participants saw teaching as a tool and/or could apply what they know to integrate technology (Figure 5.1). Teacher participants in this study were highly educated and experienced. On average participants have worked at their current school for 8 years, and the average total number of years teaching experience was 16 years. Sixty-eight percent of participants hold a Master's degree or higher. This variable was the only variable that had a significant correlation to LoI. It was a low positive correlation of .275. This may be attributed to teachers' continued education at the university level, where technology integration is increasingly being emphasized in education programs. Forty-three percent (N=23) have no experience with 1:1 as a student compared to 64% (N=34) who reported having at least a little experience as a student in 1:1. Given that the

mode of years of experience from participants was six, this may also be attributed to recent strides in university education programs from which these newer teachers graduated.

Two other teacher characteristics had low negative correlations to level of integration: total years of teaching experience (-.207) and type of course(s) taught (-.216). This relationship could possibly be caused by resistance to change for teachers who may be closer to retirement than newer teachers who see technology as a permanent element in the classroom. Some teachers with higher ears of experience may have settled into a routine of what has traditionally worked in the classroom and may not feel the need to change what works in lieu of trying a new approach, which may cost valuable instructional time. Similarly, the relationship between level of integration and type of course taught may not be directly related to the perceived ease of use or usefulness of devices. Some courses naturally lend themselves to technology use more than others. Moreover, some content areas have specific standards attached to technology use such as composition of documents and creation of presentations while others do not require more than the use of a graphing calculator.

Most participants (N=39) indicated they assign 1:1 technology-enhanced learning activities 3-5 days per week. Sixty-four percent (N=34) report allotting half the class or more to 1:1 TEL activities in a typical week. The LoI was positively correlated (.537) to the frequency of activities assigned in a typical week (see Table C.10). This contrasts with LoI showing a negative correlation (-.331) to the portion of a class period spent on 1:1 activities in a typical week. The percentage of students who bring their own device or own school-issued device to class was 96% compared to 4% who get their devices from a

school/classroom cart. These descriptives indicate that 1:1 have allowed teachers to completely bypass first-order barriers from past research (Bauer & Kenton, 2005; Ertmer, 1999). Because students have access to a device, teachers can opt more freely to integrate technology into classroom activities. The data indicates that time is being spent using 1:1 technology devices in class.

Learning occurs within contexts, and learners' experiences impact this perception of learning. 1:1 technology-enhanced learning allows teachers to meet the individual needs of 21st-century students (Christensen, Horn, & Johnson, 2011). Though respondents did agree that 1:1 technology was perceived as easy to use and useful, there were several concerns about its consistent integration into classroom activities. A common concern emerged among participants despite varying grade levels and courses taught.

This major concern was limited support and a lack of training. Analysis of responses indicated that the lack of training discussed by interviewees did not necessarily mean the absence of training. Several participants indicated they had attended professional development related to 1:1 technology, but this training was not necessarily applicable to their respective content. Kim, Kim, Lee, Spector, and DeMeester (2013) noted that though technology integration is emphasized in professional development, ample support often does not go beyond specific technology skills such as available tools or applications. Often, educators are training on what tools were available but not how to integrate them in their respective grade levels and/or content areas (Kim et al., 2013; Sahin et al., 2016). This one-size-fits-all professional development does not provide the support or authentic learning experiences necessary

to effectively integrate technology, let alone for the purposes of implementing digital literacy standards (Ertmer et al., 2012; Hamutoglu & Basarmak, 2020; Polly & Hanafin, 2010). Similarly, even when training was relevant, changes within 1:1 programs related to devices, platforms, and learning management systems made some previously effective techniques and tools defunct. For 1:1 integration to be successful and promote digital literacies, there is a need for continuous training; training that matches updates within educational organizations.

Additionally, more support and training are needed in managing 1:1 devices. Aside from limiting distractions and keeping students on track within class activities, teachers are often faced with helping students troubleshoot device issues or with technology-related skills. Interview participants noted that while they may be prepared to assist with some issues students have, they are not fully equipped to handle all that may occur. This brought up the concern that there was no specific tech support staff member that could help when issues arose. Frequently, students had to be sent to the media center, or teachers submitted help requests to an outside contractor for further assistance, which can be a time-consuming process. Given integration barriers related to time and knowledge, these types of experiences with technology may hinder the integration process, thus limiting opportunities for digital literacies to be addressed in current classrooms.

RQ2 Discussion

To address research question two, teacher technology integration currently varies within several contextual levels. On a macro level, educational organizations that adopt 1:1 technologies assist teachers in implementing technology by removing a

major barrier from past research: access. Regardless, this adoption of technology does not guarantee consistent integration among classrooms. On a micro level, the educational professional tasked with integrating devices must reconcile personal skills and pedagogy to integrate technology while also teaching and managing varied student technology skill levels. Teacher perceptions, experience, technological knowledge, and digital literacies, tech support and training levels, and time all vary and perpetually change, making a clear image of technology integration elusive. But, regardless of changes and device adoptions, interview and survey data both indicate that educational professionals are working diligently to prepare students despite many hurdles. Time is being devoted to classroom technology use in ways that support digital literacies. Teachers and students are creating and constructing information, collaborating with others, and thinking critically to problem-solve issues that may arise. The adoption of 1:1 technologies has made new, updated information easily accessible. While areas such as behaving ethically and responsibly still need attention, the repeated opportunities to learn within 1:1 TEL environments is promising. Over time, this researcher is hopeful that the emphasis on digital literacies in current 1:1 classrooms is helping both educators and students alike make progress in the world of teaching and learning.

Delimitations & Limitations

Delimitations are factors which may affect the research study but are controlled by the researcher (Creswell, 2012). This study included the following delimitations. The survey deployment took place at the end of the spring semester, thereby possibly eliciting fewer responses than would possibly be provided by teachers at other times in the school

calendar. The interviews followed near the end of the school year at times of convenience for participating teachers, which potentially elicited fewer responses due to the hectic push to close out the school year and prepare final grades. This study was delimited to teachers in specific secondary schools in the southeast and to teachers who were also enrolled in a specific university technology program. It was further delimited to teachers working in 1:1 technology-enhanced classrooms for at least one year or more. Lastly, teachers' perceptions related to 1:1 technology integration and digital literacies was delimited to this one-time survey and interview process, delimiting the possibility for change in perceptions.

Limitations are potential weaknesses within a study that may unexpectedly and/or uncontrollably constrain the interpretations of research findings (Creswell, 2015; Sampson, 2012). First, the sampling size and geographical location posed potential limitations in that results may not be generalizable to all secondary schools in the United States. The researcher collected the data for this mixed-methods study from teachers working in two schools within one suburban school district in the southeast and from teachers enrolled in an educational technology program across various states. The results of this study are limited to the sample size of the research sites and are not random. The teacher participants across the sample totaled to 53 for the quantitative section and 19 for the qualitative interviews. The small sample size may make the generalizability of results not transferable to other teachers in schools in other areas of the United States or other countries. Further, the results of this study may be impacted by the sudden, unforeseeable changes in education. Some of the research sites had undergone adoption of new devices, changes in platforms and/or devices, and changes to instructional delivery due to the

COVID-19 pandemic, which precipitated widespread changes in teaching and learning. The abrupt way in which many educators were thrust into a multitude of changes may have impacted the results.

Limitations may also derive from the instruments' reliability of participant self-reporting. The ubiquity of bias can impact data in numerous ways (Solomon, 2017; Stake, 2014; Stake, 2010). The study is limited by participants' willingness to be honest and forthright in their survey responses and interviews. Teacher participants responded to the survey and interview questions by expressing their individual perceptions and opinions based upon their time teaching in 1:1 classrooms; therefore, the data will be subject to participant bias. The data collection via online survey may over- or under-represent the perceptions within the population, resulting in findings more or less supportive of technology integration in 1:1 classrooms (Solomon, 2017; Speirs-Bridge, Fidler, McBride, Flander, Cumming, & Burgman, 2010). Participants in favor of technology integration may have chosen to respond; likewise, potential respondents with negative views of 1:1 technology may have declined to participate in the research. For example, participants who embrace technology and integrate it frequently and willingly may have reported their experiences more eagerly than those of a late adopter with limited experiences with technology (Rogers, 2005). Additionally, the wording of the survey questions may have affected participants' responses, causing true perspectives to be not reported (Hubbard, 2014). It is also possible that teachers may have limited knowledge about the subject and/or interpret digital literacy concepts in a subjective manner (Barnwell, 2012). These responses may also have been impacted by recent positive or

negative experiences. Concomitantly, the findings were conditional and relay the experiences of a small sample during a specific time period.

There is also the potential concern for insider bias (Saidin & Yaacob, 2016). The researcher is a high school English Language Arts instructor within one of the schools being studied. Given the "insider" status of the researcher, it is important to address potential bias that may invalidate the findings. To avoid any bias, the researcher utilized a set of pre-structured interview questions, eliminating the potential for leading questions within the interview. To clarify participant responses, interviewees were asked to elaborate if the answer is vague or requires clarification. The interview data was shared with each teacher participant to ensure that all information is correct and true as intended by the responder.

Implications for Professional Practice

The findings of this research study were based on analysis of data collected from secondary teachers who work in 1:1 TEL environments. Several aspects of this study's findings related to technology integration may be connected to ideas presented in previous research and theories, including the Technology Acceptance Model (Davis, 1989; Maragunic & Granic, 2015; Rogers, 2005; Solomon, 2017; Teeroovengadum et al., 2017), the Diffusion of Innovations (Rogers, 2005; Sahin, 2006), teachers' adoption patterns, beliefs, and disposition to accept change (Atkins & Vasu, 2000; Hooper & Rieber, 1995; Knezek & Christensen, 2016; Sahin et al., 2016; Straub, 2009; Solomon, 2017), the influences and barriers to 1:1 integration (Bauer & Kenton, 2005; Ertmer, 1999; Ertmer et al., 2012; Vongkulluksn et al., 2018) and digital literacies (Beetham & Sharpe, 2010; Bekker et al., 2015; Belshaw, 2014; Eshet-Alkalai,, 2004; Ferrari, 2012;

Green et al., 2014; Hatlevik, 2015; Hobbs, 20120; ISTE, 2015; Prior et al., 2016; Sparks et al., 2016). These connections lead to several implications for practices that might benefit students and education programs.

Technology Beliefs and Educational Practice

Concerning technology integration, researchers argue that educators do not always act on their beliefs (Chen, 2008; Kim et al., 2012). Despite holding positive attitudes towards technology's perceived ease of use or usefulness, they may still not integrate it in "effective, efficient, or engaging" ways (Ertmer et al., 2014; Kim et al., 2012; Spector & Merrill, 2008). This may depend on the level of integration of technology teachers identify with; however, this may change over time as educators gain more experience and training with the technology adopted. Survey respondents reported levels of integration aligned with their positive perceptions of 1:1 technology's ease of use and usefulness. The positive views of the 1:1 technology's relative advantage, compatibility, complexity, and trialability seem to contribute to teachers' willingness to utilize it within the classroom (Rogers, 2005). The implications of these perceptions point to a need for successful ideas and strategies to be recognized, modeled, and shared to grow teacher awareness and promote digital literacies. Educational stakeholders must work together to align beliefs and practices to support students in the acquisition of digital literacies. Correlational data indicated a negative relationship between perception of technology and integration levels. This indicates there is a need for more research in this area with a larger sample over a longer period as recent changes and experiences in education may have skewed teacher perceptions and integration levels in comparisons to years prior or those that will follow.

Strategic Professional Development

Technology integration is an ongoing process and requires sustained professional development to tackle the challenges present with the changes in technology (Heijden, Geldens, Beijaard, & Popeijus, 2015) These changes may be due to organizational decisions to adopt new technologies, updates to applications, or new initiatives in education. More so, findings from this study and past research (Bauer & Kenton, 2005) note the need for on-campus staff devoted to technology issues which require immediate assistance. To see improvements in digital literacies and technology integration, teachers need support to gain and expand their personal skills and experiences through continuous professional learning opportunities relevant to their courses. Educational organizations may want to offer more long-term opportunities to learn than brief, one-day sessions that are too broad to apply specifically. Data from this study found 81.1% of respondents viewed 1:1 technology as a tool and/or could apply what they knew, yet 69.8% of respondents had little to no experience with 1:1 technology as a student. This may explain why perceptions towards 1:1 technology were positive towards statements regarding its ease of use and usefulness while integration levels were negatively correlated to many of these same aspects. Their limited experience on the student side may make designing technology-enhanced tasks difficult as there may be unforeseeable issues. The implications for professional practice include a continual need for professional development opportunities for teachers and staff that will allow them to experience 1:1 technology as learners. Educational stakeholders may find success in promoting digital literacies by offering observational opportunities for teachers to watch successful implementation in other classrooms of the same content area. More relevant

experiences and knowledge may instill more frequent integration, allowing for more practice of digital literacies.

Knowledge is Power: Influences & Barriers to Integration

Teacher education and schools may benefit from knowing the influences and/or barriers teachers face to integration when in 1:1 environments. Knowing what influences teachers to integrate technology may help educational and professional development programs evaluate the extent to which its curriculum is meeting the desired outcomes of 1:1 technology and digital literacy initiatives. Most barriers explored in this study related to either time or knowledge. With proper planning, educational organizations and institutional programs can explore ways to help guard against the loss of teachers' instructional, planning, and/or personal time. Instructional and technology coaches within schools could help teachers vet tools and plan technology-enhanced instruction to meet the content requirements and promote students' digital literacies. The identification of activities and best practices for addressing student needs within specific content areas could be valuable to educators and instructional designers. To address knowledge barriers, educational organizations and core departments may want to consider technology needs assessments when preparing professional learning opportunities. This would better align with participant needs and be far more beneficial than mass overviews of a specific technology and its available functions.

CONCLUSION

Technology integration and digital literacies continue to be prioritized in K-12 education. In response, school districts continue to adopt 1:1 technology initiatives for classrooms, often without input from teachers. As Ertmer (1999) notes, technology integration is a complex challenge involving more than the acquisition of technological equipment. It is the first step in a causal chain to prepare students for college and career. The success of 1:1 programs is heavily influenced by the teachers' perceptions of technologies and their level of integration into the curriculum. Student use is heavily dictated by teacher instructional use. If educators are not integrating technology and taking opportunities to practice digital literacies, then how will students acquire these prioritized skills? Educators must navigate ways to meet educational standards while also utilizing and evaluating technology adopted "for" them and not "by" them. Therefore, it is essential to understand what barriers exist to achieving this multifaceted challenge and to understand what influences teachers to adopt and integrate technology while others do not.

This non-experimental mixed-methods study explored the extent to which instructors within 1:1 environments viewed their technology integration through quantitative survey data and, through interviews, investigated what and how teacher characteristics, influences, and barriers impact the acquisition of digital literacies within the classroom. By gaining more insight into how technology and digital literacy skills are integrated into 1:1 classrooms, we may gain insight into current integration practices as

well as barriers to implementation, furthering current literature in this area. Moreover, this research may enable educational systems to effectively align beliefs, research, and practice to support teachers in meeting newly adopted technologies and digital literacy standards.

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APPENDIX A

Quantitative Survey

Q1.1 Hello, fellow educational professionals, and thank you in advance for your assistance.

This survey is part of dissertation research being conducted by a classroom teacher and Boise State University (BSU) doctoral student, Angela Wagner.

The research focuses on 1:1 technology integration and digital literacies in the classroom. The survey takes approximately 10 minutes to complete. Your participation in this survey is voluntary and has no risks.

Potential benefits may be the identification of interventions that may impact 1:1 technology use in classroom activities. Information you provide will be kept confidential; all names of districts, schools, and individuals participating in this research will be withheld from published reports.

You may discontinue participation at any time. If you decide to discontinue, any information you provided will be immediately deleted.

If you have any questions about the study, please contact the researcher via email: angelawagner@u.boisestate.edu.

This study has been approved by the BSU Institutional Review Board (IRB) #101-SB20-197. If you have any questions about your rights as a research participant or feel you have

been placed at risk, you may contact Francine Winkle, IRB Human Subjects Coordinator, at 208-426-5401 or https://www.boisestate.edu/research-compliance/irb/.

By going forward with this survey, you are providing consent to use your responses for the purpose of this study.

Thanks again for your assistance and participation!

Q1.2 In this survey, a "1:1 classroom" refers to all students having access to a computer (often laptops) or mobile learning device (such as a tablet or iPad) as a personal tool to support their learning of school material in and out of the classroom.

SURVEY PARTICIPATION

- ○ Yes, I have at least one year of experience teaching in a 1:1 environment, and I would like to participate in this survey. (1)
- ○ No, I prefer not to participate and/or I do not have experience in a 1:1 environment. (2)

Skip To: End of Survey If Q1.2 = No, I prefer not to participate and/or I do not have experience in a 1:1 environment.

Q2.0 **DEMOGRAPHICS**

Responses to these questions will NOT be used to identify you in any way; they simply help the researcher analyze the data.

Q2.1 Please indicate which BSU Ed Tech degree program in which you are currently enrolled

- Masters of Educational Technology (MET) (1)
- Education Specialist (EdS) in Educational Technology (2)
- Doctor of Education (EdD) in Educational Technology (3)
- Other (4)

Q2.2 In your role as a classroom teacher, how many cumulative years of teaching experience do you have? (please enter a number)

_____

Q2.3 In your role as a classroom teacher, how many years have you taught at your present school? (please enter a number)

_____

Q2.4 Subject(s) I currently teach: (Select all that apply.)

- English Language Arts (1)
- Social Studies (2)
- Mathematics (3)
- Science (4)

- Foreign Language (5)
- P.E. / Wellness (6)
- Business/Finance (7)
- Fine Arts (8)
- Other (9) _____

Q2.5

Grade levels I currently teach: (Select all that apply.)

- 6th grade (6)
- 7th grade (7)
- 8th grade (8)
- 9th grade (9)
- 10th grade (10)
- 11th grade (11)
- 12th grade (12)

Q2.6 Course levels I currently teach: (Select all that apply.)

- Remedial (1)
- Standard (2)
- Honors (3)
- Advanced Placement / Dual Enrollment (4)
- Other (5) _____

Q2.7 My highest level of education completed:

- Bachelor's degree (1)
- Master's degree (2)
- +30 or Specialist's degree (3)
- Doctoral degree (4)

Q3.1 Please think about student use of 1:1 technology during classroom learning activities as you respond to the following survey questions.

The use of 1:1 technology refers to each student having a personal computing device such as a laptop, Chromebook, iPad, or tablet.

Q3.2 How much experience have you - yourself - had as a ***STUDENT*** in a classroom where 1:1 technology-enhanced learning activities are part of the classwork?

- A great deal (1)
- A lot (2)
- A moderate amount (3)
- A little (4)
- None at all (5)

Q3.3 From the statements below, please select the option that best describes your current practice in assigning 1:1 technology-enhanced learning activities to your students during

class.

- I am aware that it is available for students to use, but I have not required students to utilize it. (1)
- I am currently trying to learn the basics of integrating technology for students' use. I am often frustrated and /or lack confidence when creating 1:1 technology-based activities for my students. (2)
- I am beginning to understand the processes of integrating it. I can think of specific tasks in which it might be useful. (4)
- I am gaining a sense of confidence incorporating 1:1 technology. I am starting to feel comfortable using with its use. (6)
- I think of 1:1 technology as a teaching tool to help me (I am no longer concerned about it as technology). I can plan for students to use their 1:1 devices in multiple applications and as instructional aids. (8)
- I can apply what I know about technology in the classroom. I can easily employ 1:1 technology-based student activities during class as instructional tools. I fully integrate 1:1 technology-based activities into classroom curriculum. (10)

Q3.4 CLASSROOM INSTRUCTION:

Q3.5 The 1:1 classroom:

Has made my teaching more student-centered and less lecture-based

- Strongly Agree (1)
- Mostly Agree (2)
- Neither agree nor disagree (3)
- Mostly Disagree (4)
- Strongly Disagree (5)

Q3.6

The 1:1 classroom:

Has allowed me to routinely integrate technology into my instruction

- Strongly Agree (1)
- Mostly Agree (2)
- Neither agree nor disagree (3)
- Mostly Disagree (4)
- Strongly Disagree (5)

Q3.7 The 1:1 classroom:

Has changed my classroom's learning activities in a positive way.

- Strongly Agree (1)
- Mostly Agree (2)
- Neither agree nor disagree (3)
- Mostly Disagree (4)
- Strongly Disagree (5)

Q3.8 The 1:1 classroom:

Allows my students' learning activities to be more interactive and collaborative.

- Strongly Agree (1)
- Mostly Agree (2)
- Neither agree nor disagree (3)
- Mostly Disagree (4)
- Strongly Disagree (5)

Q3.9 STUDENTS:

Q3.10 The 1:1 classroom:

Has increased the overall level of student interaction and/or collaboration.

- Strongly Agree (1)
- Mostly Agree (2)
- Neither agree nor disagree (3)
- Mostly Disagree (4)
- Strongly Disagree (5)

Q3.11 The 1:1 classroom:

Has positively impacted student learning and achievement.

- Strongly Agree (1)
- Mostly Agree (2)
- Neither agree nor disagree (3)
- Mostly Disagree (4)
- Strongly Disagree (5)

Q3.12 The 1:1 classroom:

Has improved the quality of my students' work.

- Strongly Agree (1)
- Mostly Agree (2)
- Neither agree nor disagree (3)
- Mostly Disagree (4)
- Strongly Disagree (5)

Q3.13 READINESS:

Q3.14 The 1:1 classroom:

I know how to meaningfully integrate the use of the technology into my classroom lesson plans.

- Strongly Agree (1)
- Mostly Agree (2)
- Neither agree nor disagree (3)
- Mostly Disagree (4)
- Strongly Disagree (5)

Q3.15 The 1:1 classroom:

I can align the 1:1 activities with my district's standards-based curriculum.

- Strongly Agree (1)
- Mostly Agree (2)
- Neither agree nor disagree (3)
- Mostly Disagree (4)
- Strongly Disagree (5)

Q3.16 The 1:1 classroom:

I have received adequate training to incorporate it into my instruction.

- Strongly Agree (1)
- Mostly Agree (2)
- Neither agree nor disagree (3)
- Mostly Disagree (4)
- Strongly Disagree (5)

Q3.17 The 1:1 classroom:

My digital literacy / technology skills are adequate to conduct classes involving it.

- Strongly Agree (1)
- Mostly Agree (2)
- Neither agree nor disagree (3)
- Mostly Disagree (4)
- Strongly Disagree (5)

Q3.18 OVERALL SUPPORT:

Q3.19 The 1:1 classroom:

Parents/caregivers support our school's 1:1 technology program.

- Strongly Agree (1)
- Mostly Agree (2)
- Neither agree nor disagree (3)
- Mostly Disagree (4)
- Strongly Disagree (5)

Q3.20 The 1:1 classroom:

Community members support our school's 1:1 technology program.

- o Strongly Agree (1)
- o Mostly Agree (2)
- o Neither agree nor disagree (3)
- o Mostly Disagree (4)
- o Strongly Disagree (5)

Q3.21 The 1:1 classroom:

Our school has a well-developed technology plan that guides all technology integration efforts.

- o Strongly Agree (1)
- o Mostly Agree (2)
- o Neither agree nor disagree (3)
- o Mostly Disagree (4)
- o Strongly Disagree (5)

Q3.22 The 1:1 classroom:

Teachers in this school are generally supportive of the 1:1 technology program.

- o Strongly Agree (1)
- o Mostly Agree (2)
- o Neither agree nor disagree (3)
- o Mostly Disagree (4)
- o Strongly Disagree (5)

Q3.23 TECHNICAL SUPPORT:

Q3.24 The 1:1 classroom:

School administrators support the integration of 1:1 technology into classroom practices.

- Strongly Agree (1)
- Mostly Agree (2)
- Neither agree nor disagree (3)
- Mostly Disagree (4)
- Strongly Disagree (5)

Q3.25 The 1:1 classroom:

Most of our 1:1 devices are kept in good working condition.

- Strongly Agree (1)
- Mostly Agree (2)
- Neither agree nor disagree (3)
- Mostly Disagree (4)
- Strongly Disagree (5)

Q3.26 The 1:1 classroom:

I can readily obtain answers to technology-related questions.

- Strongly Agree (1)
- Mostly Agree (2)
- Neither agree nor disagree (3)
- Mostly Disagree (4)
- Strongly Disagree (5)

Q3.27 The 1:1 classroom:

My students have adequate access to up-to-date technology resources.

- Strongly Agree (1)
- Mostly Agree (2)
- Neither agree nor disagree (3)
- Mostly Disagree (4)
- Strongly Disagree (5)

Q3.28 The 1:1 classroom:

Materials (e.g., applications, printer, supplies, etc.) for classroom use of 1:1 technology are readily available.

- Strongly Agree (1)
- Mostly Agree (2)
- Neither agree nor disagree (3)
- Mostly Disagree (4)
- Strongly Disagree (5)

Q3.29 In a typical WEEK, how often do you assign 1:1 technology-based learning activities during class.

- Every day (5)
- 4 days per week (4)
- 3 days per week (3)
- 2 days per week (2)
- 1 day per week (1)

Q3.30 In a typical week, what portion of a class period is allotted for students to spend on 1:1 technology-based learning activities?

- All or most of it (1)
- More than half of a class (2)
- About half of the class (3)
- Less than half of the class (4)
- Only a few minutes (5)

Q3.31 How do your students obtain 1:1 technology for use during your class? (Select all that apply)

- Students bring their self-owned devices to class. (1)
- Students bring school-issued devices to class. (2)
- Students use a device from a classroom set or cart. (3)

Q4.1 DIGITAL LITERACY

Digital literacy is defined* within this study as: The responsible and appropriate use of technology to create, collaborate, think critically, and apply technical processes. This includes accessing and evaluating information to gain lifelong knowledge and skills in all subject areas.

* *assembled from many existing definitions in the literature*

Q4.2 Please select which skills or behaviors related to digital literacy that you actively work on with your own students:

- Creating knowledge (1)
- Collaboration (2)
- Critical Thinking Skills (3)
- Identifying, locating, accessing, retrieving, storing, and organizing information (technical processes) (4)
- Behaving online, and with respect to electronic information and communication, in an ethical and responsible way (5)

Display This Question:

If Q4.2 = Creating knowledge

Q4.3 Could you perhaps briefly describe some approaches and/or digital tools that you use that help students create knowledge?

_____

_____

Display This Question:

If Q4.2 = Collaboration

Q4.4 Could you perhaps briefly describe some approaches and/or digital tools that you use that help students to collaborate?

_____

_____

Display This Question:

If Q4.2 = Critical Thinking Skills

Q4.5 Could you perhaps briefly describe some approaches and/or digital tools that you use that help students develop critical thinking skills?

_____

_____

Display This Question:

If Q4.2 = Identifying, locating, accessing, retrieving, storing, and organizing information (technical processes)

Q4.6 Could you perhaps name some approaches and/or digital tools that you use that help students to identify, locate, access, retrieve, store and organize information (technical processes)

_____

_____

Display This Question:

If Q4.2 = Behaving online, and with respect to electronic information and communication, in an ethical and responsible way

Q4.7 Could you perhaps name some approaches and/or digital tools that you use that help students to behave in an ethical and responsible way, (ex., copyright issues, communicating through online tools, accounting for privacy, safety, and behavioral expectations).

_____

_____

Q5.1 Would you be willing to participate in a brief interview to discuss the influences and barriers you have experience in integrating 1:1 technologies in the classroom?

- Yes (1)
- No (2)

Display This Question:

If Q5.1 = Yes

Q5.2 Thank you for your interest in participating in a follow-up interview. Please provide your contact Information. This information will not be linked to the responses you provided above.

Name:

Telephone number:

Email address:

Best time to contact: (Days / Times)

APPENDIX B

Interview Questions

Technology is a broad concept that may mean a variety of things. For the purpose of this interview, technology refers to digital technology/technologies—that is, the digital tools we use, such as computers, laptops, iPads, handhelds, interactive whiteboards, computer software programs, etc. The use of 1:1 technology refers to each student having a personal computing device such as a laptop, Chromebook, iPad, or tablet.

What grade levels and/or courses do you teach?

Does your content, district, and/or state curriculum require the use of technology? If so, how?

Do you see yourself as being innovative with 1:1 technology in the classroom? If so, how?

How would you describe your personal computer and digital literacy skills?

What are factors that influence your decision to integrate 1:1 technology-enhanced learning activities in your instruction?

What obstacles have you overcome in order to use 1:1 technology in your instruction?

What are some issues and concerns you have regarding the use of classroom 1:1 technologies?

APPENDIX C

Descriptive Statistics

Table C.1 Teachers' Total Years of Teaching Experience (n=53)

Total Years of Teaching Experience	n	Percent
2	1	1.9
3	1	1.9
4	2	3.8
5	2	3.8
6	8	15.1
7	2	3.8
8	1	1.9
9	2	3.8
10	3	5.7
11	1	1.9
12	1	1.9
15	6	11.3
17	5	9.4
18	2	3.8
19	1	1.9
20	2	3.8
21	1	1.9
22	1	1.9
23	1	1.9
24	1	1.9
27	3	5.7
31	1	1.9
32	1	1.9

36	1	1.9
37	2	3.8
45	1	1.9
Total	**53**	**100**

Table C.2 Teacher Characteristics: Education Levels

Highest Level of Education	*N*	*%*
Bachelors	17	32.1
Masters	26	49.1
30+ or Ed.S.	7	13.2
Doctorate	3	5.7

Table C.3 Subjects Taught by Teachers

Subject Taught	N	Percent
English Language Arts	16	30.2
Social Studies	7	13.2
Math	11	20.8
Science	8	15.1
Business/Finance	1	1.9
Fine Arts	1	1.9
Other	9	17.0
Total	53	100

Table C.4 Type(s) of Grade Levels Taught by Teachers

Type of Grade Level(s) Taught	N	Percent
Middle School (single grade)	14	26.4
Middle School (> 1 grade)	5	9.4
High School (single grade)	6	11.3
High School (> 1 grade)	27	50.9
Middle & High (multiple grades)	1	1.9
Total	53	100

Table C.5 Portion of Class Allotted to 1:1 TEL per Week

Portion of class allotted to 1:1 TEL activities in typical week	N	%
Only a few minutes	10	18.9
Less than half of the class	9	17.0
About half the class	16	30.2
More than half of a class	13	24.5
All or most of it	5	9.4

Table C.6 Frequency 1:1 TEL activities assigned in class

How often 1:1 TEL activities assigned during class	N	%
1 day per week	10	18.9
2 day per week	4	7.5
3 day per week	12	22.6
4 day per week	10	18.9
Every day	17	32.1

Table C.7 Teacher Responses to PEoU by Agreement

Perceived Ease of Use of 1:1 Classroom	Strongly Agree	Agree	Neither Agree / Disagree	Disagree	Strongly Disagree
The 1:1 classroom: I know how to meaningfully integrate the use of the technology into my classroom lesson plans.	11	35	6	1	0
The 1:1 classroom: I can align the 1:1 activities with my district's standards-based curriculum.	15	31	4	3	0
The 1:1 classroom: I have received adequate training to incorporate it into my instruction.	12	19	9	9	4
The 1:1 classroom: My digital literacy / technology skills are adequate to conduct classes involving it.	15	29	6	3	0
The 1:1 classroom: Most of our 1:1 devices are kept in good working	20	28	3	2	0

condition					
The 1:1 classroom: I can readily obtain answers to technology-related questions.	10	30	6	6	0
The 1:1 classroom: My students have adequate access to up-to-date technology resources.	15	32	5	1	0
The 1:1 classroom: Materials (e.g., applications, printer, supplies, etc.) for classroom use of 1:1 technology are readily available.	11	21	7	12	2

Table C.8 Teacher Responses to OF by Agreement

Organizational Factors	Strongly Agree	Agree	Neither Agree / Disagree	Disagree	Strongly Disagree
The 1:1 classroom: Parents/caregivers support our school's 1:1 technology program.	4	36	9	2	2
The 1:1 classroom: Community members support our school's 1:1 technology program.	8	31	13	1	0
The 1:1 classroom: Our school has a well-developed technology plan that guides all technology integration efforts.	8	25	11	6	3
The 1:1 classroom: Teachers in this school are generally supportive of the 1:1 technology program.	9	34	7	3	0
The 1:1 classroom: School administrators support the integration of 1:1 technology into classroom practices.	23	25	5	0	0

Table C.9 Teacher Responses to PU by Agreement

Perceived Usefulness of 1:1 Classroom	Strongly Agree	Agree	Neither Agree / Disagree	Disagree	Strongly Disagree
The 1:1 classroom: Has made my teaching more student-centered and less lecture-based	11	24	9	7	2
The 1:1 classroom: Has allowed me to routinely integrate technology into my instruction	24	23	3	2	1
The 1:1 classroom: Has changed my classroom's learning activities in a positive way	16	25	7	4	1
The 1:1 classroom: Allows my students' learning activities to be more interactive and collaborative.	11	28	8	4	2
The 1:1 classroom: Has increased the overall level of student interaction and/or collaboration	6	21	15	7	4

The 1:1 classroom: Has positively impacted student learning and achievement.	6	23	15	8	1
The 1:1 classroom: Has improved the quality of my students' work.	3	22	14	11	3

Table C.10 Pearson Correlation LoI to 1:1 Assignment Frequencies

Correlation LoI to 1:1 Assignment Frequencies		Level of Integration Chosen
Level of Integration Chosen	Pearson Correlation	1
	Sig. (2-tailed)	
	N	52
In a typical week, how often do you assign 1:1 technology-based learning activities during class?	Pearson Correlation	.537**
	Sig. (2-tailed)	<.001
	N	52
In a typical week, what portion of class period is allotted for students to spend on 1:1 technology-based learning activities?	Pearson Correlation	-.331*
	Sig. (2-tailed)	.017
	N	52

*. Correlation is significant at the 0.05 level (2-tailed).

APPENDIX D

IRB Approval Notice

BOISE STATE UNIVERSITY
RESEARCH AND ECONOMIC DEVELOPMENT
Research Compliance

Date: October 30, 2020

To: Ross Perkins cc: Angela Wagner

From: Social & Behavioral Insitutional Review Board (SB-IRB)
c/o Office of Research Compliance (ORC)

Subject: SB-IRB Notification of Approval - Original - 101-SB20-197
Digital Literacies: Teaching in 1:1 Technology-Enhanced Learning Environments

The Boise State University IRB has approved your protocol submission. Your protocol is in compliance with this institution's Federal Wide Assurance (#0000097) and the DHHS Regulations for the Protection of Human Subjects (45 CFR 46).

Protocol Number:	**101-SB20-197**	Received:	10/21/2020	Review:	Expedited
Expires:	**10/29/2021**	Approved:	10/30/2020	Category:	7

Your approved protocol is effective until 10/29/2021. To remain open, your protocol must be renewed on an annual basis and cannot be renewed beyond 10/29/2023. For the activities to continue beyond 10/29/2023, a new protocol application must be submitted.

ORC will notify you of the protocol's upcoming expiration roughly 30 days prior to 10/29/2021. You, as the PI, have the primary responsibility to ensure any forms are submitted in a timely manner for the approved activities to continue. If the protocol is not renewed before 10/29/2021, the protocol will be closed. If you wish to continue the activities after the protocol is closed, you must submit a new protocol application for SB-IRB review and approval.

You must notify the SB-IRB of any changes to your approved protocol and the committee must review and approve these changes prior to their commencement. You should also notify the committee if your activities are complete or discontinued.

Current forms are available on the ORC website at http://goo.gl/D2FYTV

Please direct any questions or concerns to ORC at 426-5401 or humansubjects@boisestate.edu.

Thank you and good luck with your research.

1910 University Drive Boise, Idaho 83725-1139
Phone (208) 426-5401 orc@boisestate.edu