DIFFERENCES IN INNOVATIVE MINDSET BETWEEN TEACHERS IN ONE-TO-ONE LEARNING ENVIRONMENTS VERSUS TRADITIONAL CLASSROOMS

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DIFFERENCES IN INNOVATIVE MINDSET BETWEEN TEACHERS IN ONE-TO-ONE LEARNING ENVIRONMENTS VERSUS TRADITIONAL CLASSROOMS

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DIFFERENCES IN INNOVATIVE MINDSET BETWEEN TEACHERS IN ONE-TO-ONE LEARNING ENVIRONMENTS VERSUS TRADITIONAL CLASSROOMS

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ABSTRACT

This quantitative study was conducted to determine whether one-to-one learning environments foster an innovative mindset in teachers. This study also examined relationships that might exist between a teacher's mindset and their beliefs about technology integration. In addition to innovative mindset and teacher beliefs about technology integration, two additional constructs were identified and added to the study after principal component analysis was ran. The two additional constructs were named teacher involvement and teacher engagement. A survey instrument was used to sample participants to address the research questions guiding the study. While not statistically significant, survey responses from K-5 public elementary teachers in the state of Missouri with one-to-one learning environments fostered more of an innovative mindset versus teachers in traditional classrooms. Statistically significant differences were found between teachers that have an innovators' mindset and their beliefs about technology integration. For the purposes of this study, teacher involvement was defined as the extent to which teachers reflected on their practice and provided opportunities for students to build twenty-first century skills. Teachers with one-to-one learning environments did not differ significantly from teachers without one-to-one learning environments, however, survey responses did indicate that teachers with one-to-one learning environments were more involved than teachers in traditional classrooms. Teacher engagement is the extent to which a teacher differentiates his or her classroom to create personal, relevant, and engaging experiences for all students. Survey responses indicated that teachers with one-to-one learning environments were more engaged than teachers in traditional classrooms.

CHAPTER ONE: INTRODUCTION

Introduction

The changes in the nature of business organizations and the altering demands of the global economy require employees to be equipped with specific knowledge and skills (Battelle for Kids, 2019). The RAND Corporation states that workers in the twenty-first century must demonstrate strong cognitive skills and be able to problem solve, communicate, and create (Karoly & Panis, 2004). The Conference Board, Corporate Voices for Working Families, the Partnership for Twenty-first Century Learning (P21), and the Society for Human Resource Management gave a survey to 431 human resource officials in an effort to examine employers' views on the readiness of new entrants to the U.S. workforce. The survey concluded that students are ill prepared to enter the technological, knowledge-based workforce (Battelle for Kids, 2019). Additionally, in an article titled, *Pathways to Prosperity: Meeting the Challenge of Preparing Young Americans for the 21century* (2011), the authors state that there are profoundly troubling signs that the U.S. is failing in its obligation to prepare our young adults (Symonds, Schwartz, & Ferguson, 2011). They go on to say there is growing evidence to support a skills gap, meaning that many young adults are lacking the skills and work ethic needed in the workforce (Symonds et al., 2011). Currently, the American education system is functioning as a barrier to American students as it does not align with the needs and demands of the current economic workforce (Wagner, 2010).

Globalization is levelling the world and challenging the United States as never before (Cho, 2012; Freidman, 2005; Mingus, 2014). Rapid economic, technological and social changes are the result of a world that is becoming increasingly more

interconnected (Cho, 2012). Advancements in technology are changing the workforce into a more global arena. Rapid change and increased competition in the global workforce requires that workers develop twenty-first century skills to adapt quickly to changing technologies and organizational structures (Cho, 2012; Lemke, 2002). Today's students will spend their adult lives in a technology-driven, complex, multitasking, diverse and vibrant world. Workplace, jobs and skill demands require twenty-first century skills where the 4C's—communication, collaboration, critical thinking, and creativity are essential in this rising complex society (Cho, 2012; Karoly & Panis, 2004; Wagner, 2010). The Twenty-first Century Workforce Commission (2000) states that in order to thrive in today's world, "every American youth and adult needs to acquire Twenty-first Century Literacy-strong academic, thinking, reasoning, and teamwork skills, and proficiency in using technology" (p. 8). With this urgency to provide students with an education that will prepare them for the workforce they will enter, the education system should provide equitable access to this new technological world regardless of student backgrounds (Battelle for Kids, 2019; Medlin, 2016; Mills, 2016).

In Chapter One, the researcher states the problem for the study along with the purpose of the study. You will also be informed of the questions that the researcher hopes to answer as well as a null hypothesis for the study. This chapter gives the conceptual underpinning for this study listing the assumptions, limitations, and delimitations the researcher faces. Next, Chapter One states design controls for the study that the researcher may face. The researcher provides key terms so that the reader understands these terms in the context of the research paper. Finally, Chapter One closes by providing an overview of the contents discussed and what to expect in upcoming chapters.

Problem Statement

Twenty-first century learning demands that we focus on each child's individual abilities and interests at an early age (Medlin, 2016). Educators, school reformers, college professors, and employers define these abilities and interests as a broad set of knowledge, skills, work habits, and character traits believed to be critically important to success in today's world (Medlin, 2016). Since the twenty-first century has allowed American students to grow up with Internet accessible technology, the education system should provide equitable access to students in order to prepare them for the workforce they will enter (Battelle for Kids, 2019; Medlin, 2016). One-way educational organizations are embracing these skills and ensuring that students have equitable access to a twenty-first century education is by providing students with one-to-one learning environments (Gallemore, 2017; Medlin, 2016). The United States Department of Education makes educators aware of the need to leverage technology in their classrooms to provide more meaningful and authentic learning opportunities for students (National Education Technology Plan, 2016). Studies suggest that one-to-one learning environments increase student engagement and that students enjoy using multimedia, searching the Internet, and writing papers on their computer (Bebell & O'Dwyer, 2010; Suhr, Hernandez, Grimes, & Warschauer, 2010).

There is no doubt that in order for one-to-one learning environments to be successful there must be buy-in from teachers (Bebell & O'Dwyer, 2010). Bebell and O'Dwyer (2010) suggest that buy-in from teachers for tech immersion is critically important because students' school experiences with technology are largely dictated by their teachers. Unless educators bridge the gap between how students live and how

students learn, today's education system will continue to face irrelevance (Battelle for Kids, 2019). This is important to consider, as many public schools have not yet embraced all components of twenty-first century skills (Mills, 2016).

The twenty-first century has allowed American students to grow up with Internet accessible technology in their everyday activities (Medlin, 2016). This high level of engagement with technology indicates a need for the re-evaluation of instructional pedagogies and content being used in an educational institution in order to meet the needs of today's students (Chandrasekhar, 2009; Prensky, 2001). Herbert (2006) makes us aware that while educational organizations are essential in the development of creativity and innovation, there remains a profound gap between the knowledge and skills most students learn in school and the knowledge and skills they will need to possess in typical twenty-first century communities and workplaces. Knowing that employees must demonstrate innovative behavior within their organization in order to compete in a highly competitive market, education is crucial in developing creative and innovative thinking in students so that they may be successful in the job market (Andiliou & Murphy, 2010; Mingus, 2014; Wagner, 2010). In an effort to bridge this skills gap, educational institutions are bringing technology into the organization (Mills, 2016). The question that remains is whether teachers are maximizing the use of the technology by shifting their instructional pedagogies in order to meet the needs of today's students. Furthermore, does this increase in technologies and shift in instructional pedagogies develop an innovators mindset in teachers as they have more opportunities to create and be innovative in their instruction? This study seeks to determine if classrooms that have one-to-one environments develop an innovators mindset within educators.

Rationale for the study

The purpose of this causal comparative study is to test the theory of innovative mindset to compare teachers with one-to-one learning environments and teachers without one-to-one learning environments for an innovative mindset at K-5 public school classrooms in the state of Missouri. One independent variable of interest will be generally defined as teachers who have one-to-one technological devices within their classrooms. The other independent variable of interest is generally defined as teachers who do not have one-to-one technological devices in their classrooms. The dependent variable in this study is the innovative mindset and will generally be defined as the belief that the abilities, intelligence, and talents of individuals lead to the creation of new and better ideas (Couros, 2015).

Education is 19 years into the twenty-first century and while the term, twenty-first century learning, has been around since 1996, many public schools are still not implementing twenty-first century learning environments (Eye, Gilb, Hicks, 2013; International Commission on Education in the 21st Century, 1996; Mills, 2016). Battelle for Kids (2019) has developed a framework that will guide districts to the successful implementation of twenty-first century skills. Research has shown that when districts embrace this framework and develop the appropriate plan that aligns to this implementation, there is personal growth in district leaders, administrators, educators, and students (Mills, 2016).

Although there has been research done about one-to-one learning environments and on mindset, there is little to no evidence-based research on one-to-one learning environments and the innovative mindset. If educators wish to bridge the gap between

how students live and how they learn, then further research must be done on whether one-to-one learning environments foster characteristics of an innovative mindset in teachers. The purpose of this study was to explore the effects of one-to-one learning environments on fostering an innovative mindset in teachers. By conducting this research, key impacts on how one-to-one learning environments might develop characteristics of an innovator's mindset in teachers are identified to ensure that technology enhances the learning environment towards teaching of twenty-first century skills.

Research Questions

This study explored the effects of one-to-one learning environments on fostering an innovative mindset in elementary teachers. The following questions guided the research in order to complete this study:

1. What difference exists between teachers in one-to-one learning environments versus teachers not in one-to-one learning environments in terms of innovative mindset?
2. What is the relationship between a teacher's mindset and their attitude towards technology?

The following null hypotheses related to the research questions of the study existed:

H_{01}: There is no statistically significant difference between teachers in one-to-one learning environments and teachers not in one-to-one learning environments in innovative mindset.

H_{02}: There is no statistically significant relationship between teacher mindset and attitudes towards technology.

The following alternative hypotheses related to the research questions of the study existed:

H_{a1}: There is a statistically significant difference between teachers in one-to-one learning environments and teachers not in one-to-one learning environments in innovative mindset.

H_{a2}: There is a statistically significant relationship between teacher mindset and attitudes towards technology.

Theoretical Framework

Schools were first brought into legislation by the founding fathers in 1785 and 1787 (McIntosh, 2005; Tackett, 2014). In the twenty-first century, education looks vastly different than education in the late 1700's one room school house (Tackett, 2014). While the teacher was the leader of the one room schoolhouse, students were also taught by other students due to it being a multi-aged schoolhouse. Student learning consisted of rote memory and recall due to the lack or materials and time (Tackett, 2014).

Classroom structures that have been in place for many years are known as traditional classrooms (Tackett, 2014). Traditional classrooms utilize transmission or objectivism theory. In the transmission model of learning, students are receivers of information while the teacher is the disseminator of information (Tackett, 2014; Murphy, 1997). Traditional theoretical belief is that students listen while the teacher provides students information, with little communication or collaboration among students (Murphy, 1997; Stephens, 2012; Tackett, 2014).

The constructivism theory provides a contrasting view to the transmission or objectivism theory of learning. The constructivism theory of learning suggests that

learning is an active, constructive process where the learner is the constructor of knowledge (Anagün, 2018; Stephens, 2012; Tackett, 2014). Furthermore, constructivism is when people actively create or construct objective reality based off of prior knowledge. In the constructivist classroom, students are presented information in a problem-based format (Stephens, 2012; Tackett, 2014). The constructivist theory of learning has been around for many years (Tackett, 2014).

> Jean Piaget (1896-1980) was the first to state that learning is a developmental cognitive process, that students create knowledge rather than receive knowledge from the teacher. He recognized that students construct knowledge based on their experiences, and that how they do so is related to their biological, physical, and mental stage of development. (Hammond, Austin, Orcutt, & Rosso, 2001, p. 6)

A constructivist classroom allows opportunities for students to foster twenty-first century skills (Allsop, 2016). John Dewey believed that knowledge obtained at school should be able to extend to students worlds outside of school (Allsop, 2016). Many studies have been done around the constructivist classroom and twenty-first century skills, all of which agree on one outcome—when a constructivist classroom meets the knowledge and skills that students need in today's society, there is a positive impact on student learning (Allsop, 2016).

Dweck (2006) is a main theorist of mindset. Her research on mindset led to the discovery of two different mindsets: fixed and growth (Couros, 2015; Dweck, 2006). A fixed mindset is the belief that one is born with certain qualities and do not have the potential to change. Dweck (2006) says that when a person has a fixed mindset, they have an urgency to prove themselves over and over. "If you have only a certain amount of

intelligence, a certain personality, and a certain moral character—well, then you'd better prove that you have a healthy dose of them" (Dweck, 2006, p. 6). People who foster a growth mindset believe qualities can be cultivated through hard work and effort (Dweck, 2006). They believe that a person's true potential is unknown and unknowable (Dweck, 2006). Having a growth mindset leads to motivation and productivity in a variety of areas including business, education, and sports (Dweck, 2006). Dweck's (2006) research also indicated having a growth mindset improves relationships with others. Dweck (2006) revealed that when teachers are intentional about starting students off with a lesson on growth mindset before beginning their daily lessons there was an increase in student achievement.

Falko Rheinberg, a professor at the University of Potsdam, Germany, tested the idea of a growth mindset with educators (Dweck, 2006; Rheinberg, 1983). Rheinberg (1983) measured teachers' mindsets and their effect on students. He monitored students over the course of a school year. The findings of his study suggest that teachers who believe that they can have an influence on students' intelligence observed significant improvement from their low achieving students (Dweck, 2006; Rheinberg, 1983). If they entered low achieving students, they left as high achieving students. On the other hand, teachers who believed that they had no influence on student intelligence observed little change in student achievement throughout the school year (Dweck, 2006; Rheinberg, 1983).

Couros (2015) took the idea of a growth mindset a step further by introducing the idea of the innovative mindset. An innovative mindset is the belief that the abilities, intelligence, and talents of individuals lead to the creation of new and better ideas

(Couros, 2015). Couros (2015) states, “The growth mindset is crucial in one’s openness to learning. But to change education and prepare students for their futures, we need to adopt an innovator’s mindset for ourselves and instill this mindset in our students” (p. 33). Couros (2015) believes that someone with an innovators mindset will embody these eight characteristics: reflection, resilience, creativity, observation, connectedness (networked), risk-taking, problem solving, and empathy. There is currently little to no research on the innovative mindset. This study is intended to be a contribution of evidence-based research on how classrooms that are one-to-one learning environments foster characteristics of an innovators mindset in educators.

Limitations, Delimitations and Assumptions

The limitations, delimitations, and assumptions associated with the study are identified in the following sections.

Limitations. Mauch and Birch (2003), Roberts (2010), Simon (2005) have defined limitations as factors that may or will affect the study in an important way that the researcher has no control over. The limitations of this study have been recognized and are as follows:

1. Teacher perceptions and/or teacher attitudes about one-to-one technology environments may have an impact on how the questionnaire is answered by the participant.
2. Definitions of the eight characteristics of an innovator’s mindset may be perceived differently among participants and may have an impact on how the questionnaire is answered.

3. K-5 teachers in the state of Missouri may choose to not participate in the survey.
4. The researcher has no control of the response rate at which K-5 teachers in the state of Missouri complete the survey.

Delimitations. Delimitations are the areas that the researcher can control and must rationalize why these decisions were made (Roberts, 2010; Simon, 2005).

1. Only K-5 public elementary schools in the state of Missouri, chosen by a random sampling, were included in this study.
2. Participants in this study consisted of K-5 regular education teachers in the state of Missouri. For the purposes of this study, a regular education teacher is a contracted, full time teacher who teaches the traditional curriculum—reading, writing, spelling, math, and science. The researcher sought learning environments where the traditional curriculum is being taught to provide consistency in the population being surveyed in order to best answer the research questions. Providing the survey to all elementary educators would raise many more questions and would take away from the research questions that the researcher is seeking to answer since some educators do not teach the general curriculum. For example, a physical education teacher has a specified curriculum that they are required by the state of Missouri to teach with little variance to make adjustments while a regular education teacher has the autonomy to choose how the general curriculum is taught within their learning environment. Additionally, a SPED teacher works directly with students to meet goals within their

Individual Education Plans (IEP), which may or may not require the use of one-to-one technology.

3. This study took place in the state of Missouri.

Assumptions. Vogt (1993) and Simon (2005) define an assumption as a statement that is accepted to be true, for a specific purpose. Roberts (2010) says that assumptions are what the researcher takes for granted relative to the study. The assumptions of this study have been identified and are as follows:

1. It is assumed all participants that fully completed the survey gave honest responses representative of their professional beliefs.
2. It is assumed that the responses received were representative of the practices and perceptions of K-5 teachers throughout the state.

Design Controls

This quantitative study utilized a cross-sectional survey of K-5 regular education teachers in the State of Missouri. The quantitative methods used in the study served as a design control for potential researcher bias. Survey responses were anonymous to encourage honesty by the respondents. Requests for survey responses were made until a sample sufficient for generalizability of the results was achieved.

Respondents were identified as K-5 teachers within the survey instrument. Participants were asked to identify whether their classroom was one-to-one or if it did not. The remaining survey items used a 5-point Likert scale to measure each characteristic of an innovator's mindset and their attitude towards technology. Survey responses were analyzed to determine whether participants identify with characteristics of an innovator's mindset and their perceptions about technology use in the classroom to

determine if significant differences existed depending upon teacher mindset and technology.

Definition of Key Terms

For the purpose of this study, key terms were defined as follows:

Twenty-first century skills. Skills that are essential for success in today's economy, such as, critical thinking, problem-solving, collaboration, and communication (Battelle for Kids, 2019; Lemke, 2002; Mills, 2016; Trilling & Fadel, 2009).

One-to-one learning environments. One-to-one learning environments is when all teachers and students within an organization have access to an Internet connected device, to use as a personal tool, for their school work (Corn, Tagsold, & Patel, 2011; Islam & Gronlund, 2016; Medlin, 2016).

Innovation. Innovation is a way of thinking that creates something new and better (Couros, 2015).

Innovative Mindset. An innovative mindset is the belief that the abilities, intelligence, and talents of an individual lead to the creation of new and better ideas (Couros, 2015).

Empathetic. An empathetic teacher is one who thinks about the classroom environment and the learning opportunities from the students' point of view. Teachers must form relationships with his or her students so that he or she might understand them and be able to tap into their interests (Couros, 2015).

Problem Finders/Solvers. Teachers must lead by example by teaching students to be self-starters that continuously evaluate their learning. Educators must stop telling

kids how to learn and act as a facilitator that encourages them to find their own solutions to problems (Couros, 2015).

Risk Takers. Educators must understand that for innovative teaching and learning to exist, educators must take risks. "Risk is necessary to ensure that we are meeting the needs of each unique student" (Couros, 2015, p. 51). Taking risks means that teachers have a willingness to create new opportunities for students and knowing that they might not work for every student. The educator with an innovative mindset is able to draw on experience while maintaining an openness to try to something new (Couros, 2015).

Networked. Couros (2015) notes the following, "CIO.com writer Tom Kaneshige says, 'Every idea is fundamentally a network of ideas…When you create an environment that allows the kinds of serendipitous connections to form, [innovative ideas] are more likely to happen'" (p. 52). Being an individual that is connected both locally and globally allows opportunities for the sharing of ideas, the ability to clarify our thinking, and the development of new and better ideas. Innovation occurs when teachers collaborate to learn and practice new strategies (Couros, 2015).

Observant. Teachers have the opportunity to make connections between ideas and information that others freely share online in order to create and expand learning environments for students. An unknown author says that, "Inspiration is everywhere and often in unexpected places; you just have to keep your eyes open" (Couros, 2015, p. 55).

Creators. Creation is crucial. Educators should focus on the creation of new ideas in order to provide learning opportunities for students to make personal connections to

the information. Making personal connections to learning is an important key for deep learning (Couros, 2015).

Resilient. Teachers that foster an innovative mindset are constantly coming up with new ideas. These teachers will face challenges from others because of their new ideas. They must be prepared to move forward even when others reject their ideas. Educators must teach students how to face adversity and be resilient in the face of rejection or fear (Couros, 2015).

Reflective. Educators with an innovative mindset must consistently reflect as it ensures that we are asking the right questions. Example: What worked? What did not? What would I change? What questions do I have moving forward? Reflecting allows us to make our own connections and therefore, deepen our thinking (Couros, 2015).

Regular Education Teachers. For the purposes of this study, a regular education teacher is a contracted, full time teacher who teaches the traditional curriculum—reading, writing, spelling, math, and science.

Summary

Educators are several years into the twenty-first century and many schools have still not figured out how to incorporate all components of twenty-first century skills into their classrooms (Eye et al., 2013; International Commission on Education in the 21st Century, 1996; Mills, 2016). There is a need for educators to embrace this change and become more innovative in their practices in order to meet students' needs. Educators that foster a growth mindset, believing that they have the ability to learn and grow, are more likely to embrace this change and foster an innovative mindset (Couros, 2015). An innovative mindset is the belief that abilities, intelligence, and talents are developed so

that they lead to the creation of new and better ideas (Couros, 2015). There is little to no evidence-based research on one-to-one learning environments, a key component of twenty-first century learning, and an innovative mindset.

Through the dissemination of a survey completed through a random sampling of public elementary school teachers, grades kindergarten through fifth grade, the researcher wanted to find out if educators in one-to-one learning environments foster more characteristics of an innovator's mindset than educators in environments with little to no technology. The first chapter ends by describing the assumptions, limitations, and delimitations of the study and how the researcher planned to control those areas. Lastly, the researcher listed key terms that were used throughout the study in order to provide the reader with a clear understanding of important terms.

Chapter Two of this paper will provide a literature review and theoretical framework of existing research and explores the body of literature that speaks to the topic of one-to-one technology and characteristics of an innovative mindset. The literature review is organized thematically and focuses on twenty-first century learning, one-to-one technology and mindsets. Chapter Three will outline the process and methodology for this quantitative study, as well as discussing the participants that were involved in the study. Chapter Four will present the data that was collected and analyzed. Chapter Five will provide a summary of this project, the implications and significance of these findings, as well as recommendations for the educational environment and future studies.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

Introduction

As the world transitions into the twenty-first century, technology has become engrained into every part of our lives (Mingus, 2014). Our current and future students are growing up in a complex, diverse, and globalized society (Battelle for Kids, 2019; Cho, 2012; International Society for Technology in Education, 2017; Mingus, 2014; Thomas, 2016; Wagner, 2010). This society will require that students be able to think critically, communicate effectively, work collaboratively, and be innovative (Mills, 2016; Mingus, 2014; Wagner, 2010). To remain globally competitive and develop engaged citizenship, it is the responsibility of educators to weave twenty-first century competencies and expertise throughout the learning experience in order to prepare our students and future citizens for the global workforce that they will face (Cho, 2012; Mingus, 2014; Thomas, 2016; Wagner, 2010). Educators have the corporate responsibility of making sure that our students are prepared for life outside of the public school system (Hargreaves & Shirley, 2009). Battelle for Kids (2019) has created a framework that illustrates the skills and knowledge that all students of the twenty-first century need to succeed in work, life, and citizenship (Mingus, 2014). A component of this framework includes technological skills that are crucial for students to develop in order to find success in their futures. One way that educational organizations have changed their instructional pedagogy is by providing students with their own technological device (Gallemore, 2017; Mingus, 2014). While providing students with their own technological device will not transform learning, technology helps enable transformative learning (Thomas, 2016). This shift in instruction requires that teachers have an open mind to the vast amount of opportunities that

technology can provide in order to prepare students to be a twenty-first century learner and citizen.

As the world transitions into the twenty-first century, technology continues to become more embedded into society (Cho, 2012; Mingus, 2014; Thomas, 2016). With technology engrained into almost every area of our lives, the society that our current students and future citizens are growing up in has become increasingly complex, diverse, and globalized (Cho, 2012; International Commission on Education in the 21st Century, 1996; Mingus, 2014; Thomas, 2016; Zhao, 2009). With this continued progression of societies' focus, likewise, there must be a change that comes about in how we train educators and prepare our future citizens and current students (Cho, 2012; Mingus, 2014; Wagner, 2010). A complex, diverse, and globalized society means that the global job market will require evolved skills in comparison to those of the past (Cho, 2012; Fusaralli, 2005; Mingus, 2014) Mingus (2014), Cho (2012), and Wagner (2010) explain that students must possess greater global competencies; students that are able to think critically, communicate effectively, work collaboratively, and be innovative. Education systems have begun to rethink their instructional practices in an effort to prepare students so that they will have the skills necessary to compete in a global workforce (Cho, 2012; Friedmann, 2005; Mingus, 2014, Sabochik, 2010). Battelle for Kids (2019) has developed a set of skills that they believe will prepare students to compete in the global workforce that they will face.

Twenty-first Century Learning

What exactly is twenty-first century learning? The phrase twenty-first century learning has become an integral part of educational discourse (Mishra & Kereluik, 2011).

There is a feeling that there is a disconnect between the centuries of the past and the one that we are emerging into as education demands new ways of thinking, teaching and learning (Mishra & Kereluik, 2011). In fact, many books and reports have been written that criticize the current goals and practices of the current education system (Keengwe, Onchiwari & Wachira, 2008; Kozma, 2003; Mishra & Kereluik, 2011; Zhao, 2009). Many authors and groups suggest that the educational system needs to be restructured to foster higher order cognitive processes such as the ability to adapt, be curious, collaborate, critically think, and creatively problem-solve (Gallemore, 2017; Horn & Staker, 2010; Kereluik & Mishra, 2011; Pheeraphan, 2013).

Comparable to this are individuals, groups and organizations that offer a range of recommendations for what are broadly labeled "twenty-first century skills" (Mishra & Kereluik, 2011). While the term twenty-first century skills is widely used within educational discourse, there doesn't seem to be a clear definition of what the twenty-first century skills even are (Mishra & Kereluik, 2011). In fact, individuals, groups, and organizations have created their own frameworks in which to make sense of these skills (Mishra & Kereluik, 2011). A few organizations that have sought to identify the knowledge required to succeed in the twenty-first century include the American Association of Colleges and Universities, the Center for Public Education, the International Society for Technology in Education and Battelle for Kids; international bodies such as the European Union; business interests such as the Organization for Economic Cooperation and Development, as well as, the Metiri Group; individual scholars such as Howard Gardner, Yong Zhao, and Daniel Pink (Mishra & Kereluik, 2011). For the purposes of this study, the researcher focuses on a commonly known

framework within the educational system, Battelle for Kids Twenty-First Century Learning Framework.

Battelle for Kids Twenty-First Century Learning Framework

Formed in 2019, Battelle for Kids, formerly known as Partnerships for 21st Century Learning, seeks to position twenty-first century readiness at the center of K-12 education in the United States (Battelle for Kids, 2019; Cho, 2012; Ledward & Hirata, 2011; Mishra & Kereluik, 2011). Battelle for Kids (2019) states:

> Twenty-first century learning environments and opportunities are essential to prepare all students for the challenges of work, life, and citizenship in the 21st century and beyond, as well as ensure ongoing innovation in our economy and the health of our democracy" (Battelle for Kids, 2019, para. 1).

The Partnerships for 21st Century Learning framework (P21) is born out of the notion that we now live in a technology rich environment that brings with it an abundance of information available at our fingertips, rapid advancements in technology, and the extraordinary ability to collaborate and communicate with others around the world (Anagün, 2018; Battelle for Kids, 2019; Mishra & Kereluik, 2011). The P21 Framework is built from a solid foundation of content knowledge that is supported by specific skills, expertise, and literacies required for success in personal and professional life (Anagün, 2018; Battelle for Kids, 2019; Mishra & Kereluik, 2011). The foundational content knowledge within the framework focuses on essential skills for success in a highly digital and globalized world. Examples of these essential skills include critical thinking, problem solving, communication and collaboration (Anagün, 2018; Battelle for Kids, 2019; Mishra & Kereluik, 2011). Success in the new digital age require individuals of the

twenty-first century to possess and utilize a wide range of learning and innovation skills related to information, media and technology (Anagün, 2018; Battelle for Kids, 2019; Mishra & Kereluik, 2011). Additionally, P21 asserts that learning and innovation skills are skills that will separate individuals who are prepared for life and work and those who are not (Mishra & Kereluik, 2011). In addition to the P21 framework for necessary knowledge and skills, P21 also advocates for student outcomes and educational support systems into a unified framework in order to offer a holistic and systemic view of how educational organizations can re-conceptualize and reinvigorate public education (Battelle for Kids, 2019; Bellanca & Brandt, 2010; Mishra & Kereluik, 2011).

The starting point for the development of this framework was to look at mastery of student outcomes (Battelle for Kids, 2019). Student outcomes are defined as core academic subjects, twenty-first century themes, and twenty-first century skills that are expected from students once they leave school to venture successfully into higher education, workplaces, and independent life (Battelle for Kids, 2019; Bellanca et al., 2010). Within the framework, student outcomes are identified as content and twenty-first century themes; life and career skills; learning and innovation skills; and information, media, and technology skills (Battelle for Kids, 2019; Bellanca et al., 2010). After student outcomes were solidified, stakeholders began to look at the support systems required for results that truly matter for students (Battelle for Kids, 2019; Bellanca et al., 2010). Refer to Appendix A for a visual of the Framework for 21st Century Learning.

Support Systems

Support systems are necessary in order to achieve student outcomes (Battelle for Kids, 2019; Puccia, 2016). The support systems that undergird the twenty-first century

learning student outcomes are standards and assessment; curriculum and instruction; professional development; and learning environments (Anagün, 2018; Battelle for Kids, 2019; Bellanca et al., 2010; Cho, 2012; Puccia, 2016). While student outcomes were created first in the framework, the researcher examines the twenty-first century learning support systems in detail and then explains the twenty-first century learning student outcomes to give the reader a deeper understanding.

Standards and assessments.

The first support system of twenty-first century learning outcomes are standards and assessments. Battelle for Kids (2019) emphasizes the importance of students mastering core academic subjects, performing to high standards, and gaining the cognitive social skills that enable them to deal with the complex problems of our age (Alismail & McGuire, 2015). Standards are important to consider as they drive the critical elements of the American educational system—the curriculum that schools follow, the textbooks students read, and the tests that they take (Battelle for Kids, 2019). Additionally, standards establish the levels of performance that students, teachers, and schools are expected to meet (Alismail & McGuire, 2015; Battelle for Kids, 2019). The Missouri Department of Elementary and Secondary Education (DESE) is in agreement with Battelle for Kids on the importance of using standards to measure performance in both teachers and students. Additionally, the International Society for Technology in Education (ISTE) has both teacher and student standards for learning, teaching, and leading in a digital age and are widely recognized and adopted worldwide (2017).

Curriculum and instruction.

Puccia (2016) and Battelle for Kids (2019) expresses the urgency of implementing assessments that appropriately measure student skills and content knowledge. Furthermore, assessments must be meaningful, relevant, and supportive of long-term success in the twenty-first century (Battelle for Kids, 2019). In *How People Learn*, Bransford (2000) supports the importance of creating an assessment-centered learning environment where summative assignments are used at the end of a unit to measure mastery of standards and formative assessments are used in conjunction with feedback to provide students with opportunities to revise and improve the quality of their thinking and understanding. Educational organizations should choose curriculum that aligns to the standards and assessments set by the district and state.

Once educators know the standards and assessments that they must use to guide their instruction, they can determine what instruction will look like by using a twenty-first century curriculum. Educators should employ instruction across content areas that integrates innovative research-proven teaching strategies, modern learning technologies, and real world resources and contexts learning methods (Alismail & McGuire, 2015; Battelle for Kids, 2019; Lombardi, 2007). One way educators can do this is by developing curricula for understanding (Battelle for Kids, 2019; Bransford, 2000; Darling-Hammond, 2010; Wiggins & McTighe, 2005). Organizations should spend time unpacking the standards to articulate essential concepts and skills and build widespread consensus around the big ideas and essential questions we are asking students (Battelle for Kids, 2019; Bransford, 2000; Darling-Hammond, 2010; Wiggins & McTighe, 2005). Educators should use curriculum-embedded performance-based assessments regularly for

student mastery. Lastly, organizations should be committed to twenty-first century curriculum design processes and to collaborate with others to ensure that we are preparing students for the twenty-first century (Alismail & McGuire, 2015; Battelle for Kids, 2019; Bransford, 2000; Darling-Hammond, 2010; Wiggins & McTighe, 2005). It is imperative that teachers have a deep understanding of the curriculum through continual professional development.

Professional development.

Professional development in the twenty-first century should provide teachers with the capacity to identify student's particular learning styles, intelligences, strengths and weaknesses and match those with a variety of strategies to meet diverse learners needs (Battelle for Kids, 2019; Learning Forward, n.d.; Puccia, 2016). Another characteristic of professional development around twenty-first century skills is enabling collaboration among all participants by allowing teachers and principals to construct their own learning communities (Battelle for Kids, 2019; International Commission on Education in the 21st Century, 1996; Learning Forward, n.d.; Puccia, 2016; Rikkerink, M., Verbeeten, H., Simons, R., & Ritzen, H., 2016). The purpose of learning communities is to model the kinds of learning that should take place in the twenty-first century—classrooms that balance direct instruction and project-oriented teaching methods (Battelle for Kids, 2019; Learning Forward, n.d.; Puccia, 2016). In fact, one of the Learning Forward professional learning standards is for learning communities to be established in educational organizations in order to increase teacher effectiveness and increase student achievement (Learning Forward, n.d.; Puccia, 2016). Districts should also tap the expertise within a school or district through coaching, mentoring, and team teaching (Battelle for Kids,

2019; Learning Forward, n.d.). The National Board for Professional Teaching Standards (2018) supports this characteristic of effective professional development by seeking to develop highly qualified educators that have knowledge and skills to use best practices in their classrooms. Administrators should support educators in their role of facilitators of learning and their use of twenty-first century technology tools (Battelle for Kids, 2019; Gallemore, 2017; Learning Forward, n.d.). This includes providing professional learning training that helps teachers overcome barriers to technology use in the classroom (Gallemore, 2017; Learning Forward, n.d.; Tackett, 2014). Additionally, professional development is important for teachers to engage in as it leads to changes in the educational system and increases teacher engagement to adopt educational innovations (Nadelson & Seifert, 2016). Lastly, the educational organization should create scalable and sustainable professional development for teachers that builds their capacity to create twenty-first century learning environments.

Learning environments.

The learning environment should enable students to learn in relevant, real world twenty-first century contexts through learning practices, human support, and physical environments (Alismail & McGuire, 2015; Battelle for Kids, 2019; Puccia, 2016). In fact, researchers found that linking content to real-world context lets students engage in the learning environment effectively and promotes future skills that students will need such as critical thinking, problem solving, and collaboration (Alismail & McGuire, 2015; Herrington & Kervin, 2007; Puccia, 2016). However, the development of these skills will not be successful unless the physical environment of the school is setup for group, team, and individual learning (Battelle for Kids, 2019; Puccia, 2016). Twenty-first century

facilities will need to be equipped with multiple flexible workstations, learning studios, and specialty labs to facilitate the creativity, collaboration, exploration, problem solving, and knowledge sharing that must occur in the 21st century (Puccia, 2016).

Student Outcomes

The Partnership for Twenty-first Century Learning Framework also outlines the skills necessary to meet the need of today's global society (Battelle for Kids, 2019). Student outcomes are core academic subjects, twenty-first century themes, and twenty-first century skills (Battelle for Kids, 2019). The outcomes are important for us to consider because students will have to have shown mastery of these skills when they venture into higher education, workplaces, and independent life (Bellanca et al., 2010). Within the Twenty-First Century Learning Framework, the student outcomes are defined as content and twenty-first century themes; life and career skills; learning and innovation skills; and information, media, and technology skills (Battelle for Kids, 2019).

Key subjects—3R's and twenty-first century themes.

Twenty-First Century Student Outcomes outline core subjects and interdisciplinary themes (Battelle for Kids, 2019). Twenty-first century core subjects included in the framework are: English/language Arts, world languages, mathematics, economics, science, geography, history, and government and civics (Battelle for Kids, 2019; Cho, 2012). Battelle for Kids (2019) also lists interdisciplinary themes within the framework and are defined as follows: global awareness; financial, economic, business, and entrepreneurial literacy; civic literacy; health literacy; and environmental literacy (Battelle for Kids, 2019; Cho, 2012). Students should be given opportunities within their curriculum to learn and develop various literacies such as civic, financial, environmental,

health, and global awareness (Alismail & McGuire, 2015). Being literate in multiple areas is important because it enables students to make informed decisions that preparethem to face challenges in the global community as well as give them the opportunity to be successful in the workplace (Alismail & McGuire, 2015; Wiggins & McTighe, 2005).

Global awareness.

Global awareness is the ability for students to work collaboratively with individuals that represent diverse cultures to understand and address global issues (Battelle for Kids, 2019; Lemke, 2002). Globalization has been defined as the world being flat and the globe being no more than a village (Bagceli & Onur, 2017; Friedman, 2005; Zhao, 2009; Zhao, 2015). Globalization is levelling the world and challenging the United States as never before (Cho, 2012; Freidman, 2005; Mingus, 2014). Globalization has transformed the skill set that students of the twenty-first century must master (Battelle for Kids, 2019; Cho, 2012; Kivunja, 2014; Lemke, 2002; Trilling & Fadel, 2009; Zhao, 2015). The rate at which our world is changing requires students to develop new technological skills in order to enable technology innovations (Advanced Leadership Initiative, 2005; Kivunja, 2014; Trilling & Fadel, 2009). This is important, as innovation is what drives globalization (Advanced Leadership Initiative, 2005). Educators must meet the challenges of global awareness by adapting to meet the twenty-first century needs of students (Advanced Leadership Initiative, 2005; Battelle for Kids, 2019; Cho, 2012; enGuage, 2002; Lemke, 2002; Zhao, 2009; Zhao, 2015). Additionally, educators must have multicultural points of view that respect differences (Bagceli & Onur, 2017). One challenge that educational organizations face is preparing students so that they can secure

a job that will provide for them and their families (Zhao, 2009). Employers now have the ability to find talent all over the world by either moving to where the talent is or directly moving the talent to where it is needed (Zhao, 2009). A second challenge that educators face is preparing students to interact with people from different cultures and countries (Zhao, 2009). Lastly, educators must accept the challenge of helping students adopt a global view in their thinking and develop a sense of global citizenship. Global awareness is vital to our economy, our national security, and our multicultural society (Bagceli & Onur, 2017; Zhao, 2009).

Financial, economic, business, and entrepreneurial literacy.

It is important for students to develop financial, economic, business, and entrepreneurial literacy as changes in the nature of business organizations and the altering demands of the global economy require employees to be equipped with specific knowledge and skills (Battelle for Kids, 2019; Business Roundtable, 2018; Zhao, 2015). Students should be given opportunities in which they can use entrepreneurial skills to enhance workplace productivity and understand career options (Battelle for Kids, 2019). One way that educators can develop entrepreneurial skills in students is by allowing them to be creative, as it is a precursor to innovation and the cornerstone of entrepreneurship (Ruppert, 2010). They should understand the role of the economy within society and make appropriate economic choices (Battelle for Kids, 2019).

Civic literacy.

Civic Literacy is defined as the ability to manage technology and govern its use in a way that promotes public good and protects society, the environment, and democratic ideals (Lemke, 2002). It is important for students of the twenty-first century to

understand the rate at which our world is changing and how to respond in ethical ways. (Battelle for Kids, 2019; DiCicco, 2016; Lemke, 2002). Students should understand local and global implications of decisions made, exercise their rights, and be given the resources to be an informed member of society (Battelle for Kids, 2019; DiCicco, 2016). Branson (2003) agrees with the importance of civic education and reminds us:

> Some scholars claim that knowledge of the values and principles of democracy may be the most significant component of education for democratic citizenship, because when democratic norms are well understood they may have a kind of "grip on the mind" that makes them operate at a deeply internalized if not conscious level (p. 5).

Health literacy.

Being health literate means that students can identify public health and safety issues both nationally and internationally (Battelle for Kids, 2019). The health literate student understands basic health information, takes preventative measures with their health, and can monitor their personal and family health goals (Battelle for Kids, 2019; Levin-Zamir & Bertschi, 2018). The U.S. Department of Health and Human Services created the National Action Plan to Improve Healthy Literacy (2017) in an effort to provide everyone with access to accurate and actionable health information, deliver person-centered health information and services, and support lifelong learning and skills to promote good health.

Environmental literacy.

Now more than ever, humans have a great impact on the planet's systems (Hollwegg, Taylor, Bybee, Marcinkowski, McBeth, & Zoido, 2011). Because of this, it is

important for students of the twenty-first century to be environmentally literate (Battelle for Kids, 2019). An environmentally literate person is someone who can work by themselves or with others to make informed decisions concerning the environment and will act on these decisions in order to improve the quality of life of other individuals, societies, and global environment (Battelle for Kids, 2019; Hollwegg et al., 2011).

Information, media, and technology skills.

Technology is an essential part in learners' lives and can enable educational change towards an innovative and creative school environment (Ferrari, Cachia, & Punie, 2009). Mishra, Koehler, and Henriksen (2011) argue that the best uses of technology in education must be grounded in a creative mindset that embraces a willingness to take risks. In an era where students have access to an abundance of information via the Internet, rapid changes in technology tools, and opportunities to collaborate and make individual contributions on an unprecedented scale of educators must be able to prepare them to create, evaluate, and effectively utilize information, media, and technology in the twenty-first century (Battelle for Kids, 2019; Bellanca et al., 2010; Pheeraphan, 2013).

Information literacy.

Information Literacy is among the most cited skills necessary for success in the twenty-first century (Mishra & Kereluik, 2011). In fact, the American Association of School Librarians and the Association for Educational Communications and Technology (1998) states in their publication *Information Power: Building Partnerships for Learning* that informational literacy is "a keystone of lifelong learning" (Lemke, 2002). Information Literacy, or digital literacy, requires learners to be able to access and evaluate information to then use and manage information in an ethical manner (Battelle

for Kids, 2019; Catts & Lau, 2008; Gretter & Yadav, 2016; Lemke, 2002; Mishra & Kereluik, 2011; Pheeraphan, 2013; Wilson, Grizzle, & Tuazon, 2013).

Media literacy.

Media Literacy is the ability for students to critically engage with media messages and increase their ability to access, understand, analyze, use and create media products (Battelle for Kids, 2019; Lee & So, 2014). It encompasses how a student analyzes media and becomes a creator of media (Battelle for Kids, 2019). In analyzing media, students of the twenty-first century should understand how and why media messages are made along with identifying their purpose (Battelle for Kids, 2019; Gretter & Yadav, 2016; Wilson et al., 2013). They should demonstrate an understanding of how media can influence beliefs and behaviors by including or excluding certain points of view (Battelle for Kids, 2019). Pheeraphan (2013) says that media literacy is not only about students being able to access, use, analyze, evaluate and create media but to do so with responsibility and ethics. Like the information literate student, the twenty-first century student should apply a fundamental understanding of the ethical and legal issues that surround the access and use of media (Battelle for Kids, 2019).

Information, communication, and technology literacy (ICT)

ICT is one of the powerful tools to utilize twenty-first century skills (Munyengabe, Haiyan, & Yiyi, 2018; Pearlman, 2010; Pheeraphan, 2013). ICT is defined as the ability to use digital technology, communication tools to locate, evaluate, and create information (Pheeraphan, 2013). Students that foster ICT skills are able to access, share, analyze, and present information gained from a variety of sources and in multiple ways (Battelle for Kids, 2019; Munyengabe et al., 2018; Pheeraphan, 2013). Educators

must provide students with opportunities to develop these skills within their curriculum (Munyengabe et al., 2018; Pheeraphan, 2013). Embedding ICT into the curriculum not only enhances the learning experiences of students but also develops students' skills in many ways, such as thinking ability, self-direction, self-regulation, communication and collaboration skills (Pheeraphan, 2013). The ICT strand of the Framework for Twenty-First Century Learning states that, in this category, students should demonstrate proficiency in applying technology to their lives effectively (Battelle for Kids, 2019). They should be able to use digital technologies, communication/networking tools and social networks to access, manage, integrate, evaluate, and create information so that students can successfully function in a knowledge economy (Battelle for Kids, 2019).

Life and Career Skills

Today's life and work environments ask students to do more than utilize thinking skills and content knowledge (Battelle for Kids, 2019). In the globally competitive information age, students must pay rigorous attention to developing adequate life and career skills in order to navigate complex life and work environments (Battelle for Kids, 2019; Kivunja, 2015). Educators have always incorporated life skills into their pedagogy (Battelle for Kids, 2019; Brandt, R. & Bellanca, J., 2010). However, the challenge for educators today is to deliver these skills deliberately, strategically, and in a variety of contexts (Battelle for Kids, 2019). Flexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, and leadership and responsibility are the essential life and career skills that students need to foster in today's society (Battelle for Kids, 2019; Kivunja, 2015; Trilling & Fadel, 2009). Advanced economies need people who can adapt and contribute to organizations,

products and processes and also have the skills to keep learning and adjusting to change (Bellanca et al., 2010; Pheeraphan, 2013). These skills are important for students to foster in order to successfully navigate complex life and work environments.

Learning and Innovation Skills

Battelle for Kids (2019) provides definitions within the Framework for Twenty-First Century Learning to help us understand the context for which we perceive this information. It is of critical importance for students to develop learning and innovation skills as they will be the ones that separate students who are prepared for more complex work and life environments, and those who are not (Battelle for Kids, 2019). A focus on creativity, critical thinking, communication and collaboration is essential to prepare students for the future (Kivunja, 2015).

Critical thinking and problem solving.

Critical thinking is the ability to analyze, interpret, evaluate, summarize and synthesize information (Alismail & McGuire, 2015; Trilling & Fadel, 2009). Students must also grow into citizens who can recognize problems, apply knowledge, and come up with solutions to real world situations (Mingus, 2014). "Developing students who are independent enough to think critically about academic subject matter and real-life problems is an educational objective of paramount importance to our educational system as well as greater society" (Tsui, 2002, p. 185). Tsui (2002) continues to address the imperativeness of teaching student's critical thinking and problem solving skills by stating that teachers should focus on teaching students how to think versus what to think. The ability to think critically is invaluable to students' futures because it prepares them to tackle a multitude of challenges that they will face throughout their lives (Tsui, 2002).

Furthermore, students that have learned critical thinking and problem solving skills foster other abilities like being able to approach things from a new perspective and have a willingness to look at tasks with an open mind (Mingus, 2014; Notar & Padgett, 2010). Additionally, Notar and Padgett (2010) believe that these skills enable learners to focus on the value of finding new ideas, listening to others, and supporting others when they come up with new ideas.

Communication and collaboration.

Collaboration and communication go hand in hand, as you cannot have collaboration without effective communication (Battelle for Kids, 2019). Ruppert (2010) says that organizations need workers with the ability to think analytically, communicate effectively and work collaboratively. Communication is defined as the ability to compose, view, and communicate their ideas in order to understand oral or written communication (Pheeraphan, 2013). Effective communicators in the twenty-first century will have to be able to articulate their thoughts and ideas and listen effectively to decipher meaning in a conversation (Battelle for Kids, 2019; Lemke, 2002). Ravitz (2014) asserts that students are effective communicators when they are able to recognize their own thoughts, data and findings, and share these effectively through a variety of media sources. They should use communication for a variety of purposes, such as, to inform, instruct, motivate, or persuade (Battelle for Kids, 2019). Students of the twenty-first century should be able to communicate effectively in diverse situations (Battelle for Kids, 2019).

Battelle for Kids (2019), Pheeraphan (2013) and Ravtiz (2014) define the components of collaborating with others as demonstrating the ability to work both

effectively and respectively with various teams, exercising flexibility and a willingness to compromise to accomplish a common goal, and assuming shared responsibility for collaborative work and valuing the contributions of each member of the team. Brandt & Bellanca (2010) states that the nature of collaboration is shifting to a more sophisticated skill-set. Workers of the twenty-first century must be able to collaborate both face-to-face and across the globe (Mingus, 2014).

Creativity and innovation.

Battelle for Kids (2019) advocates for a focus on the skills of creativity and innovation in order to equip our young people for the future rather than the past (Henriksen, Mishra, & Fisser, 2016; Herbert, 2006; Lewis, 2009). The rapid pace of technology development, at which is driven by human creativity, calls for a focus on students of the twenty-first century to use a wide range of idea creation strategies, such as brainstorming in order to create new and worthwhile ideas (Battelle for Kids, 2019; Henriksen et al., 2016; Lemke, 2002; Zhao, 2012). They should be able to elaborate, refine, analyze, and evaluate their creations so that they can improve their ideas to maximize creative efforts (Battelle for Kids, 2019). Creativity does not simply take place with an individual but also within a field or domain, so students should be provided opportunities to collaborate with others in order to create new ideas (Battelle for Kids, 2019; Csikszentmihalyi, 1990; Henriksen et al., 2016; Lemke, 2002). Within these collaborative groups, students should be able to effectively communicate their new ideas to others (Battelle for Kids, 2019; Csikszentmihalyi, 1990; Henriksen et al., 2016). Just as students communicate their ideas, they should possess an openness and willingness to listen to others' perspectives; incorporating input and providing feedback (Battelle for

Kids, 2019; Csikszentmihalyi, 1990; Henriksen et al., 2016). Throughout this process, students should view failure as an opportunity to learn, as creativity is a dynamic process that emerges through a system of interactions (Battelle for Kids, 2019; Henricksen et al., 2016). In taking risks, students should form an understanding that creativity and innovation is a long-term repeated process of small successes and frequent mistakes (Battelle for Kids, 2019; Lemke, 2002). Only when the individual, field, and domain agree that something is creative should students act on their act on their creative ideas to make a tangible and useful contribution to the field in which the innovation will occur (Battelle for Kids, 2019; Henricksen et al., 2016; Lemke, 2002).

Creativity Background and Theories

Ferrari et al. (2009) states that creativity and innovation in education are considered to have strong links to knowledge and learning. The Education Commission of the States published an interview with Ken Robinson who stated, "…if America wants to remain competitive in the global markets of the 21st century, creativity is not a luxury" (Herbert, 2006, p. 39). Creativity is defined in many ways but all definitions allude to the creation of something novel or of value. Csikszentmihalyi (1990) proposes a systemic view of creativity to help us conceptually understand creativity. The connection between creativity and innovation is then made within this section. With an understanding of both definitions—creativity and innovation, the terms creative learning and innovative teaching are defined. This section ends by forming a connection between creativity in education and its implications.

There are many definitions for the word creativity. Amabile (2013) and Henriksen et al. (2016) define creativity as a process and/or product, and is generally thought of as

the production of useful solutions to problems, and novel or effective ideas. According to Ferrari et al. (2009), creativity is a product or process that shows a balance of originality and value. Mingus (2014) states that creativity is the energy which innovation uses to complete the task.

Csikszentmihalyi (1990) proposes a systemic view of creativity. His system is composed of three entities, the domain, the field, and the individual. The domain is a culture that contain symbolic rules. The individual is a person who brings novelty into the domain. The field is identified by a field of experts who recognize and validate the interaction. Csikszentmihalyi (1990) asserts that creativity lies in the interaction of the individual, the domain, and the field. When these interactions take place, this is where creative work emerges and functions among these three areas (Csikszentmihalyi, 1990). As the domain indicates, the individual, the domain, and the field work together reciprocally to decide if something is creative (Csikszentmihalyi, 1990). In the level of the individual, individual people produce creative work, ideas, art, or new discovery (Csikszentmihalyi, 1990). Henriksen et al. (2016) suggests that creativity does not happen here alone. It is within the level of the domain, areas of specialized knowledge (Csikszentmihalyi, 1990). In the level of the domain, the individual uses tools, rules, conventions, knowledge, norms, and systems of techniques, codes, or symbols encourage a person to discover new ideas in the domain (Csikszentmihalyi, 1990). In the level of the field, creative work is dispersed to an audience to make an impact (Csikszentmihalyi, 1990).

Creativity has multiple entry points within the system (Henriksen et al., 2016). The creativity triangle informs our concerns of how we think about the systemic aspects

of creativity in education (Henriksen et al., 2016). Given this, we must consider how and where it might be infused through entry points (Henriksen et al., 2016). In identifying stakeholders that play a role in the process, we decide where to place our emphasis (Henriksen et al., 2016). The field, the domain, the individual and their interconnectedness are changed by content creation and sharing technologies (Henriksen et al., 2016). Please refer to Appendix B to see how these multiple entry points connect in Csikszentmihalyi's Creativity Triangle.

Creativity and innovation are intertwined (Ferrari et al., 2009). Creativity is seen as the source of innovation, and innovating in turn as the implementation of creativity (Ferrari et al., 2009). Ferrari et al., goes on to say that creativity is the infinite source of innovation (Ferrari et al., 2009). Henriksen et al. (2016) and Lewis (2009) noted that creativity is a coveted quality of thinking and an important aspect of innovation and change. Ferrari et al. goes on to define innovation as the application of such a process or product in order to benefit a domain or field (Ferrari et al., 2009).

Furthermore, creative learning requires that teachers use innovative strategies to teach students (Ferrari et al., 2009). Creative learning is defined as any learning which involves understanding and new awareness that allows the learner to go beyond theoretical acquisition, and focuses on thinking skills (Ferrari et al., 2009). Robert Sternberg, director of the Psychology of Abilities, Competencies, and Expertise Center (PACE) says creativity is a willingness to see problems in a new way and to take sensible risks (Dillon, 2006). According to Robert Sternberg's investment theory, creativity is a decision and can therefore be developed (Dillon, 2006). Ferrari et al. (2009) supports Sternberg's theory in saying that creativity is conceptualized as a skill. Therefore, it is an

ability that can be developed and fostered (Ferrari et al., 2009). When students have cultivated creativity, they are able to see problems in a new way and take sensible risks. This leads to the creation of something new, something innovative.

Innovation is the application of a process or product in order to benefit a domain or field (Ferrari et al., 2009). Innovative teaching is the process leading to creative learning, the implementation of new methods, tools and contents which could benefit learners and their creative potential (Ferrari et al., 2009). It involves both the practice of teaching creativity and applying innovation to teaching (Ferrari et al., 2009). The first step towards creative learning and innovative teaching involves an understanding of the meaning of creativity in education and its implications.

Runco (1999) helps us to better understand creativity in education by explaining that teachers, parents, children and other educational stakeholders hold a tacit knowledge about creativity manifested in opinions and expectations. This knowledge contradicts what research shows creativity is. Ferrari et al. (2009) suggests that this tacit knowledge can have detrimental effects on attempts to foster creativity in schools. This tacit and shared knowledge builds up a series of implicit theories, which explain how ordinary people think about creativity. These implicit theories are different from the ones held and are scientifically tested by researchers. Runco (1999) calls these explicit theories. An example of an implicit theory on creativity in education is that it is limited only to the arts. An example of an explicit theory on creativity in education is that it can be applied to every subject. Another example is that only those with pure talent can be creative *(implicit)* versus creativity being a learned skill *(explicit).* Please refer to Appendix C for a visual of implicit and explicit theories of creativity for education.

Creativity and innovation are the pathway to the next set of skills, which is putting thought into actions to solve problems (Mingus, 2014). Education is essential in developing creative and innovative skills (Andiliou & Murphy, 2010; Ferrari et al., 2009). Herbert (2006) informs us that educational organizations are essential in the development of creativity and innovation. While the development of these skills is essential, there remains a profound gap between the knowledge and skills students are learning in school and the knowledge and skills they will need to possess in typical twenty-first century communities and workplaces, including creativity and innovation skills (Herbert, 2006). The skills that students gain from their elementary and secondary educations and the ways in which they acquire those skills, must be rethought. The Bureau of Labor Statistics states that the percentage of workers in traditional industry will soon fall below 20 percent (Herbert, 2006). According to the United States Census, jobs and employment in many creative industries are growing faster as a whole and make up approximately 30 percent of our countries current workforce (Herbert, 2006). The data discloses that the creative industries are in fact a growth sector of the United States economy, outpacing total business growth in the nation (Herbert, 2006). Creativity must be a staple of the American workforce, as it is a critical component in determining the ability of the workforce to be flexible, adaptable, and highly creative (Herbert, 2006). Innovation is critical for organizations to sustain and succeed (Amabile, 1988; Kontoghiorghes, Awbrey, & Feurig, 2005; van de Ven, 1986; West & Farr, 1992).

Education is seen as central in fostering creative and innovative skills in students (Thurlings, Evers, & Vermeulen, 2015). The need to teach students twenty-first century skills is crucial as organizations and employees in highly competitive markets must be

innovative for the sake of survival (Thurlings, Evers, & Vermeulen, 2015). Creativity and innovation are becoming increasingly important for the development of the twenty-first century knowledge society. Both skills contribute to economic prosperity as well as to social and individual wellness (Ferrari et al., 2009). They serve as essential factors to a competitive and dynamic country. This means that students must take part in today's participatory culture, which includes becoming creators of knowledge rather than being passive consumers of information (Gretter & Yadav, 2016). Florida (2002) states that the key for future economic growth is in attracting and retaining creative people.

Ferrari et al. (2009) states that creativity and innovation in education are considered to have strong links to knowledge and learning. The Education Commission of the States published an interview with Ken Robinson who stated, "…if America wants to remain competitive in the global markets of the 21 century, creativity is not a luxury" (Herbert, 2006, p. 39). Csikzentmihalyi (1990) proposes that there are three elements that make-up creativity—the domain, the field, and the individual. The individual has an idea within an area of interest and presents it to a field of experts that either deny or accept the idea. Creativity and innovation are intertwined as creativity is seen as the source of innovation and innovating in turn as the implementation of creativity (Ferrari et al., 2009). When looking at creativity within education, the terms creative learning and innovative teaching are used to describe creative processes. Runco (1999) helps us to better understand creativity in education by explaining that stakeholders within education hold a tacit knowledge about creativity. This tacit knowledge prohibits educators from fostering creativity in schools (Runco, 1999). Since education is essential in developing creative and innovative skills educators must shift this implicit theory to explicit theory

so that students can foster twenty-first century skills (Runco, 1999). Creativity and innovation are becoming increasingly important for the development of twenty-first century skills. Students who develop these skills will contribute to economic prosperity as well as to social and individual wellness (Ferrari et al., 2009). Creativity and innovation are the drivers for successful technology integration in education.

Creativity and Innovation in Education with Technology Integration

"Technological change is driven by human creativity, and in turn provides new contexts and tools for creative output. Given this reciprocal relationship between creativity and technology we suggest that teaching and learning must emphasize their connection" (Henriksen, Hoelting, & The Deep-Play Research Group, 2016, pgs. 27-28). Furthermore, creativity and technology must intersect in twenty-first century classrooms (Henriksen et al., 2016; Lemke, 2002). Technology plays an important role in learners' lives and can enable educational change towards an innovative and creative school environment (Ferrari et al., 2009). New technologies are rapidly changing the way educators look at teaching and learning. The rapid pace of new technology development has presented a challenge for classroom technology integration (Gallemore, 2017; Medlin, 2016).

These new technologies allow for educators to be innovative in creating and sharing ideas and content, thus, creating a challenge in how to best use the technology to provide opportunities for students to be creative (Ferrari et al., 2009). We must consider the development and impact of learning technology not in isolation, but alongside opportunities for students to be creative (Ferrari et al., 2009). Technology in education gives students the opportunity to engage in the real world, helping them increase their

understanding and develop creativity and innovation skills (Jacobsen, 2001). Mishra et al. (2006) argue that best uses of educational technology must be grounded in a creative mindset that embraces openness for the new and intellectual risk-taking. In an economy in which the creation of knowledge is replacing the creation of products, the ability to breathe life into ideas, solve difficult problems, and dissect complex issues becomes an attribute that is critical to develop (Dillon, 2006).

When educators embrace a creative mindset and understand the ways in which technology can present content creatively, they have the power to unlock students' creative and innovative potential (Henriksen et al., 2016). According to Davidovitch and Milgram (2006), creativity is linked to teachers' effectiveness. Creative teachers show a willingness to try new things, give assignments that are authentic to real world, and use cross-disciplinary approaches to learning. As a result, their students tend to be enthusiastic and engaged (Kiely, 1998), building the skills and habits of mind for success in problem solving and applying knowledge (Zhao, 2012).

One-to-One Computing

Cho (2012) and Friedman (2005) describe the world as being flat, an environment where the world is a single global market. Rapid economic, technological and social changes are the result of a world that is becoming increasingly more interconnected (Cho, 2012). Advancements in technology are changing the workforce into a more global arena. Today's students will spend their adult lives in a technology-driven, complex, multitasking, diverse and vibrant world. Workplace, jobs and skill demands require twenty-first century skills where the 4C's—communication, collaboration, critical thinking, and creativity are essential in this rising complex society (Battelle for Kids,

2019; Cho, 2012; Karoly & Panis, 2004; Lemke, 2002). The Twenty-First Century Workforce Commission (2000) states that in order to thrive in today's world, "every American youth and adult needs to acquire 21st Century Literacy-strong academic, thinking, reasoning, and teamwork skills, and proficiency in using technology" (p. 8). In this environment, people across the world collaborate and compete using technological devices and applications such as computers, email, professional networks, and teleconferencing (Chandrasekhar, 2009). Educational institutions should prepare students, citizens of the twenty-first century, to have the necessary skills to face the challenges of the global marketplace (Chandrasekhar, 2009). In an effort to prepare students to face the challenges of the global marketplace, one-to-one initiatives have become popular solutions due to their perceived potential to span the digital age and traditional instructional divide occurring in schools today (Gallemore, 2017; Larkin &Finger, 201; Medlin, 2016).

One-to-one computing is when all students within an organization have access to a device, to use as a personal tool, for their school work (Chandrasekhar, 2009; Islam & Gronlund, 2016). The purpose of providing students with their own personal tool for learning is to enhance students learning and foster the development of twenty-first century skills (Islam & Gronlund, 2016). Warschauer (2006) reports that one-to-one laptop programs make a difference when it comes to engaging students in innovation, creativity, autonomy, and independent research—all components of twenty-first century skills. There are a huge number of one-to one implementations across the developed world (Islam & Gronlund, 2016; Larkin & Finger, 2012). Peck and Sprenger (2008) estimated that there were over 14,000 United States public schools that had already

implemented the use of one-to-one devices in their schools (Islam & Gronlund, 2016). There are many studies that suggest that one-to-one computing has an impact on work methods and requires a fundamental change in the view of learning and education (Means, 2010; Rosso 2010).

Teacher's Role in One-to-One Classroom Environments

Barrios (2004) says that people born after 1976 have been raised in an environment with access to digital technologies; this includes students today in kindergarten through post-secondary education who are part of the first generation that have grown up with new and emerging technologies. These students are known as digital natives (Chandrasekhar, 2009; Prensky, 2001), native speakers of digital languages, and millennials (Barrios, 2004; Chandrasekhar, 2009; Howe & Strauss, 2000). These students are a part of a new digital media culture where they learn, work, play, communicate, shop, and create communities vastly different from those of their parents (Chandrasekhar, 2009; Tapscott, 2008). One-to-one computing allows students the opportunities to be highly engaged in learning activities, apply learning strategies, collaborate with their peers on their work, use problem-solving and critical-thinking skills on project-based activities, find information, and analyze and communicate the knowledge they've acquired throughout the learning process (Chandrasekhar, 2009; Gulek & Demirtas, 2005). This high level of engagement with technology indicates a need for the re-evaluation of instructional pedagogies and content used in an educational institution in order to meet the needs of the digital natives (Chandrasekhar, 2009; Prensky, 2001). However, it may be difficult for educators responsible for teaching digital native students, as they may be novices in the use of technologies themselves. To aid in this, the

International Society for Technology Education (ISTE) has developed National Education Technology Standards for both students and teachers that guide educators in teaching students of the twenty-first century (2017).

Educators exposed to the digital environment later in life are digital immigrants (Prensky, 2001). Prensky states that digital immigrants are trying to teach a student population that speaks a new digital language (2001). In order to prepare digital natives for the digital world, the instructional practices of digital immigrant educators must include some of the current and emerging technologies in teaching and learning (Barrios, 2004; Chandrasekhar, 2009; Simon, 2005).

In February and March of 2005 a survey titled, Teachers Talk Tech, reported on a survey with 1,000 teachers (Ascione, 2005; Chandrasekhar, 2009). In the survey, 86% of teachers said that technology had changed the way they taught and 55% said that it had an impact on their instructional practices (Ascione, 2005; Chandrasekhar, 2009). While many teachers believed in the value of technology to enhance their students' learning, they did not use the technology to its maximum potential (Congress of the U.S., W.D.O. of T.A., 1995). Chandrasekhar (2009), Windschitl and Sahl (2002), and Schaumburg (2001) claimed that teacher belief systems and attitudes played a critical role in the effective implementation of any innovative strategy.

In a study conducted by Windschitl and Sahl (2002), they observed three middle school teachers in a one-to-one program. They observed that the presence of technology in the school did not necessarily result in higher use of technology for instruction in the classroom. Even with a considerable amount of professional development, teachers did not always use computers to support student learning (Lowther, Ross, & Morrison, 2003).

Teachers who made computers a fundamental part of their daily instruction were generally highly motivated individuals who sought to grow in their profession (Becker & Riel, 2000; Schaumberg, 2001). In the instructional technology adoption cycle (Rogers, 2003), these teachers were considered early adopters because they were eager to try new technologies within their classrooms to enhance student learning (Chandrasekhar, 2009).

Mindset

Dweck (2006) describes that the idea of mindset explains why intelligence and talent may not bring us success and how these two components can actually stand in the way of finding success. Additionally, Dweck's (2006) research on mindset explains why praising intelligence and talents of people doesn't foster self-esteem and accomplishment, but jeopardizes them (Dweck, 2006). Her research goes on to acknowledge that when people have this idea put into their brain it raises grades and productivity (Dweck, 2006). Mindsets are beliefs about yourself and your most basic qualities—your intelligence, your talents, your personality (Dweck, 2006). Dweck (2006) says that there are two different mindsets that individuals can adopt—fixed mindset or growth mindset. People with a fixed mindset believe that they are born with certain traits (Dweck, 2006). They believe that they are born with a certain amount of brains and talents and that nothing can change that (Dweck, 2006). People with a growth mindset believe that brains and talents can be developed through effort and dedication (Dweck, 2006).

The illiterate of the twenty-first century will no longer be individuals that cannot read or write, but individuals who cannot learn, unlearn, and relearn (Battelle for Kids, 2019). Those that have the ability to learn, unlearn, or relearn have a growth mindset. Dweck (2006), the early theorist of mindset, says that people with a growth mindset

believe that brains and talents can be developed through effort and dedication. The National Association of Elementary School Principals (2012) suggests that the key to developing a progressive technology-infused campus is not about money but about the mindset of all stakeholders within the campus. We must adopt a mindset that allows for us to welcome new challenges, embrace change, and be a risk-taker (Couros, 2015).

The mindset a person possesses is important because it determines how people respond to daily situations and ultimately to change (Dweck, 2006). It is important that one is aware of their mindset since it can determine perceived ability. Sternberg (2005), states that the main reason people achieve expertise is through purposeful engagement, not some fixed prior ability. Binet once said that it's not always the people who start out the smartest who end up the smartest (Dweck, 2006). Mindset is important to consider because it gives insight into what characteristics of an innovative mindset are fostered when a teacher implements a one-to-one technology learning environment.

Growth mindset

In a growth mindset, one believes that brains and talent can be developed through effort and dedication (Dweck, 2006). People with a growth mindset believe that with hard work and practice, opportunities are within the realm of his or her ability. This belief leads the learner to try and, ultimately grow (Dweck, 2006; Stauffer, 2015). An openness to learn is a direct result of adopting a growth mindset (Couros, 2015; Dweck, 2006). Educators must teach their students how to be lifelong learners (Battelle for Kids, 2019). Auten (2013) supported Dweck's (2006) work on growth mindset noting that fostering a growth mindset is important in the twenty-first century.

Schools should invest in the creation of professional development that exploits twenty-first century learning and innovates how teachers learn through, "inquiry, design, and collaborative approaches that build a strong community of professional educators" (Trilling & Fadel, 2009, p. 124). Teachers that embrace twenty-first century learning environments, create opportunities for themselves and their students to be innovative. Researchers note that we are roughly 15 years into the twenty-first century and the development of twenty-first century skills and the adoption of twenty-first century skills into schools is a prevailing concern in our globalized and hyper-connected society (Mills, 2016). Since administrators are the driving force behind creating a school culture that blends twenty-first century learning into their curriculum, they were the participants in Mills' study. His findings concluded that administrators who have successfully implemented twenty-first century teaching are distinguished as authentic, discerning, facilitative, collaborative, and communicative. In an in-depth description of the themes of the twenty-first century administrators, Mills (2016) states that these administrators have developed a growth mindset and recognize that a growth mindset is crucial for teachers to establish when implementing twenty-first century teaching into their classrooms. Administrators recognize that teachers changing their mindset takes time but can be done. Mills (2016) also concluded that these administrators were reflective—a characteristic of someone who has an innovators mindset. The study stated that in order for twenty-first century teaching to take place, one must be networked—another characteristic of someone who has an innovators mindset (Couros 2016; Mills, 2016).

There are many positive effects on students when the teacher fosters a growth mindset in herself and her students. First, training students on growth mindset can

increase test scores (Blackwell, Trzesniewski, & Dweck, 2007; Boaler, 2016; Good, Aronson, & Inzlicht, 2003; Yeager & Dweck, 2012). Growth mindedness allows students the opportunity to use deeper learning strategies in which to recover from poor grades (Grant & Dweck, 2003). Providing interventions, the summer before students head off to college can increase the percentage of students earning twelve or more credits during their first term (Yeager & Dweck, 2012). Teaching a growth mindset to students seems to decrease and even close the achievement gap. When Black or Latino students adopt a growth mindset, their grades and achievement test scores look similar to those of their non-stereotyped peers (Good et al., 2003). Additionally, when females foster a growth mindset, their grades and achievement test scores look similar in mathematics to those of their male classmates (Blackwell et al., 2007; Good et al., 2003).

As one thinks about learning environments in the twenty-first century, it is evident through research that a growth mindset is essential (Auten, 2013). While research proves that a growth mindset is essential to teaching twenty-first century skills to students, Mills (2016) study notes characteristics of teachers who are successfully implementing twenty-first century teaching in their classrooms that lend themselves to having an innovators mindset.

Innovative mindset

The innovative mindset takes the growth mindset a step further. Couros (2015) defines an innovative mindset as the belief that the abilities, intelligence, and talents are developed so that they lead to the creation of new and better ideas. In order to prepare students for their futures, educators must adopt an innovator's mindset (Couros, 2015). We must take the knowledge acquired and focus on creating something with it (Couros,

2015). Couros (2015) identifies eight characteristics in an educator that fosters an innovative mindset.

The first characteristic of an educator who cultivates an innovative mindset is empathy (Couros, 2015). Charles Darwin identified empathy as a key survival skill (Boltz, Henriksen, & Mishra, 2015). Empathy is particularly important today because of the increasing use of teams and the rapid pace of globalization (Boltz et al., 2015). An empathetic educator is one who puts him/herself into the shoes of the student and creates a classroom environment and learning environments that allow students to interact with content in a meaningful way (Couros, 2015). Engaging in empathy can cause our mental models and others to overlap which breaks down differences and leads us to recognize similarities (Boltz et al., 2015; Davis, 2009). When educators think about the classroom and learning opportunities from a students' point of view, educators can create learning opportunities for students to be effective problem finders/solvers.

A problem finder/solver in education understands that the world is not step-by-step or linear, therefore, we should not ask students to solve problems in a sequential order (Couros, 2015). It is not having students find the answer to problems but teachers asking the question, "How can I create a generation of problem finders" (Couros, 2015)? The Framework for Twenty-First Century Learning has included problem solving as an essential skill that our students need to find success in the twenty-first century (Battelle for Kids, 2019). Tsui (2002) continues to address the imperativeness of teaching student's critical thinking and problem solving skills by stating that teachers should focus on teaching students how to think versus what to think. The ability to think critically is invaluable to students' futures because it prepares them to tackle a multitude of

challenges that they will face throughout their lives (Tsui, 2002). Being a problem finder/solver is providing students with opportunities to be self-starters and to continually reflect on how they might improve their education to effectively learn (Couros, 2015). Asking students to find their own solutions rather than telling them how to learn involves taking risks. Furthermore, students that have learned critical thinking and problem solving skills foster other abilities like being able to approach things from a new perspective and have a willingness to look at tasks with an open mind (Mingus, 2014; Notar & Padgett, 2010). Becoming a problem-finder/solver means that students feel comfortable taking risks to identify problems and seek their own solutions.

Being a risk-taker is another component of an educator who possesses an innovator's mindset (Couros, 2015). Lemke (2002) defines risk taking as the willingness to make mistakes, advocate unpopular positions or tackle extremely challenging problems without obvious solutions so that one's personal growth, integrity and accomplishments are enhanced. Risk-takers as educators are necessary to ensure that the needs of students are met (Couros, 2015). Since educators cannot meet the needs of every student the same way, they must create new learning opportunities that will reach all learners (Couros, 2015). Educators that take risks in their practice are helping to develop our students into the leaders and learners of today and the future (Couros, 2015). They find the balance between drawing on experience while maintaining a willingness to try something new (Couros, 2015; Dweck, 2006; Nadelson & Seifert, 2016). Risk-takers ask the question, "Is there a better way to teach this lesson to meet the needs of these learners?" Not only is it important for teachers to be risk-takers in their work but it is equally important for students to be risk-takers in the twenty-first century. In fact, the

enGauge Twenty-First Century Skills Framework (2003) has risk-taking listed as a core skill that students will need to develop in the twenty-first century. Another way educators can take-risks in their practice is to collaborate with networks to come up with new ideas (Couros, 2015).

Couros (2015) says that networks are crucial to innovation. The power of belonging to networks is sharing ideas, clarifying our thinking, and developing new and better ideas (Boholano, 2017; Couros, 2015). Couros (2015) goes on to say that while face-to-face networking is crucial and still valuable in education, social media provides a place for ideas to spread. Networks allow educators to share their ideas with others on a global scale which makes you think more deeply about what it is you are sharing (Boholano, 2017; Couros, 2015). The idea of sharing your ideas with others on a global scale supports the ISTE Standards for Teachers (2017) which asks teachers to engage in professional growth and leadership by participating in local and global professional learning networks. Participating in local and global professional learning networks allows educators to observe what other educators are sharing so that teachers can improve their practice or gain the courage to try something new (Couros, 2015). Additionally, having wider networks allows educators to innovate within our rapidly changing field (Moore, 2016). Networking allows educators to produce citizens who are not only intelligent, but who are also more capable of leading, collaborating, and networking with productive people around the world (Cho, 2012; Wagner, 2010).

Being observant is another characteristic of someone who fosters an innovative mindset (Couros, 2015). Couros (2015) suggests that when educators become networked to people across the world, they start to see how they can reach students in a variety of

ways (Couros, 2015; Lombardi, 2007). Some of the best ideas that we can apply to education, do not come from education (Couros, 2015). Making connections between ideas and information that are being shared freely online allows educators to expand the learning possibilities for their students (Couros, 2015). Lombardi (2007) also says that networking through social media allows students to collaborate with one another, share their ideas, and construct new knowledge. Creating new learning opportunities for students ties to the next component of an educator who has developed an innovators mindset—creator.

Creation is crucial (Couros, 2015). Creation is crucial because it allows students to make personal connections to information, which is an important key for deeper learning (Couros, 2015). In fact, creation is one of the key components to the development of twenty-first century skills—creativity, critical thinking and problem solving—is for students to become creators of knowledge (Gretter & Yadav, 2016). The Center for Accelerated Learning says,

> Learning is creation, not consumption. Knowledge is not something a learner absorbs, but something a learner creates. Learning happens when a learner integrates new knowledge and skill into his or her existing structure of self. Learning is literally a matter of creating new meanings, new neural networks, and new patterns of electro/chemical interactions within one's total brain/body system. (Couros, 2015, p. 55)

Sternberg asserts this by saying that creativity is the willingness to see problems in new ways and to take risks (Dillon, 2006).

Being resilient is another characteristic of an educator with an innovative mindset (Couros, 2015). Dweck (2006) and Couros (2015) believe that the twenty-first century will belong to the passionate and resilient learners. Often times, educators that are innovative are often questioned because they are continuously coming up with new and better ideas (Couros, 2015). Couros (2015) states that educators that are innovative are questioned because most people are comfortable with a known average than with dealing with the unknown (Couros, 2015). Furthermore, educators with an innovative mindset face pushback and rejection in an effort to disguise people's fear of moving forward (Couros, 2015). Educators that are innovative must be prepared to move forward, even when the risk of rejection is involved (Couros, 2015). In the classroom, we should provide challenging opportunities for our students that focus on creating and forming powerful connections to concepts (Couros, 2015). While this takes more time, it builds resilience within our students that will prepare them for the real-world (Couros, 2015; Sagor, 1996). Acknowledging students' efforts, strategies, concentration or persistence promotes a growth mindset in students as it emphasizes learning through mistakes and being resilient (Dweck, 2006). How you recover from failure and move forward is important to how you learn and how you live (Couros, 2015; Sagor, 1996). Reflection is key in the steps you take to move forward after you fail.

Reflection is imperative in education and innovation as it guarantees that we are asking valuable questions, such as, "What worked? What didn't? What would I change? What questions do I have moving forward?" (Couros, 2015; Messman & Mulder, 2012). Reflection is the process of innovation development and is a necessary task in innovation (Couros, 2015; Messman & Mulder, 2012). K-12 teachers are expected to take a

reflective approach to their practice and seek ways of being more effective at engaging their students and offering progressive curriculum and instruction (Loughran, 2002; Nadelson & Seifert, 2016). As important as it is for teachers to be reflective, the National Educator's Association also asserts that students should reflect on learning experiences and processes in order to make judgements and decisions within the classroom and society. In the book, *How People Learn*, metacognition is the third step of the learning process and is essential in helping students take control of their own learning by defining learning goals and monitoring their progress in achieving them (Bransford, 2000), thus, allowing students to make their own connections to deepen their learning (Couros, 2015).

There is much research that shows that for organizations to find success, it is critical for innovation to exist within the organizations (Amabile, 1988; Kontoghiorghes, Awbrey, & Feurig, 2005; Nonaka & Takeuchi, 1995; Thurlings et al., 2015; van de Ven, 1986; West & Farr, 1992). It is especially important that organizations and employees within highly competitive markets behave in an innovative manner in order to ensure their effectiveness and competitive advantage (Messman & Mulder, 2012; Thurlings et al., 2015). Innovation exists within an organization when employees demonstrate innovative behavior. De Jong and den Hartog (2005) and Konermann (2012) define innovative work behavior as self-initiated innovative behavior. De Jong and Den Hartog (2005) and Messman and Mulder (2012) go on to say that self-initiated work behavior is a process in which new ideas are generated, created, developed, applied, promoted, realized, and modified to benefit employee role performance. Knowing that employees must demonstrate innovative behavior within their organization in order to compete in a highly competitive market, education is crucial in developing creative and innovative

thinking in students so that they may be successful in the job market (Andiliou & Murphy, 2010; Messman & Mulder, 2012).

Summary

Looking back in history, children were educated through life experiences; people learned from other humans (Tackett, 2014). In the sixteenth and seventeenth centuries, the idea of an intentionally structured place to learn came to fruition—the public education system. Over time, in addition to the acceptance of education in America, came another important evolution—education shifted from "thinking" to "doing". Education today is not simply about ideas, but how these ideas can be applied through science and technology. Battelle for Kids (2019) recognizes this urgency and have provided a framework that emphasizes necessary skills students will need to be prepared for society and the globalized workforce that they will face. Providing students with twenty-first century learning environments and opportunities through the use of technology will prepare students for the challenges of work, life, and citizenship. Many educational organizations have implemented one-to-one learning environments in an effort to create twenty-first century learning environments. In addition to providing students with twenty-first century learning environments, educators must be careful to not praise students on their intelligence but the processes that they engage in throughout the learning opportunities educators provide for their students (Dweck, 2006). Acknowledging students' efforts, strategies, concentration or persistence promotes a growth mindset in students as it emphasizes learning through mistakes and being resilient (Dweck, 2006). Dweck (2006) and Couros (2015) believe that the twenty-first century will belong to the passionate and resilient learners. Providing students with twenty-first

century learning environments and opportunities are essential to preparing students for the challenges that they will face in work, life, and citizenship and ensures ongoing innovation in our economy and the health of our democracy (Battelle for Kids, 2019).

Chapter Three will outline the process and methodology for this quantitative study and the participants that were involved in the study. Chapter Four presents data the researcher collected and the results found through evidence collected. Chapter Five provides a summary of this project, the implications and significance of these findings, as well as recommendations for the educational environment and future studies.

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

Introduction

The purpose of this quantitative study was to determine if one-to-one learning environments foster an innovative mindset in teachers as compared to teachers that do not teach in one-to-one learning environments. School districts have increasingly adopted one-to-one learning environments as an effort to develop twenty-first century skills in students. The study explored whether one-to-one learning environments develop an innovative mindset in kindergarten through fifth grade teachers at public elementary schools in the state of Missouri.

A survey was used to sample participants. Surveys were e-mailed to public elementary school principals with a request that the principals forward the survey to at least one K-2 grade regular education teacher and one 3-5 grade regular education teacher in their school. Participants identified themselves as teachers who have one-to-one learning environments or teachers who do not have one-to-one learning environments. The survey items gathered information about teacher perceptions regarding the characteristics of an innovators mindset and their attitudes regarding technology. This chapter describes the research questions and hypotheses, the participants and research design, and research procedures utilized in the study.

The research questions that were asked are as follows:

1. What difference exists between teachers in one-to-one learning environments versus teachers not in one-to-one learning environments in terms of innovative mindset?

2. What is the relationship between a teacher's mindset and their attitude towards technology?

The following null hypotheses related to the research questions of the study existed:

H_{01}: There is no statistically significant difference between teachers in one-to-one learning environments and teachers not in one-to-one learning environments in innovative mindset.

H_{02}: There is no statistically significant relationship between teacher mindset and attitudes towards technology.

The following alternative hypotheses related to the research questions of the study existed:

H_{a1}: There is a statistically significant difference between teachers in one-to-one learning environments and teachers not in one-to-one learning environments in innovative mindset.

H_{a2}: There is statistically significant relationship between teacher mindset and attitudes towards technology.

Research Setting

The scope of this study encompassed a random sampling of kindergarten through fifth grade public elementary school settings across the state of Missouri in an effort to offer a comprehensive analysis of the impact of one-to-one learning environments fostering characteristics of an innovative mindset in elementary educators. Surveys were sent to elementary public schools in Missouri. Private schools were not considered when sending the survey out. Surveys were sent to elementary principals who were asked to forward the survey to one K-2 grade teacher and one 3-5 grade teacher in their building to

identify if one-to-one learning environments foster characteristics of an innovative mindset in elementary school teachers. Due to the nature of data collection, the researcher sought to have a cross section of all teachers, not just teachers who were perceived as innovative, technologically savvy, or have great rapport with students. After successful gathering of this information, the survey was analyzed.

Research Design

Teacher survey. The researcher created a survey instrument that examined whether educators in classrooms that had one-to-one learning environments foster more characteristics of an innovator's mindset than educators' classrooms that do not have one-to-one learning environments and also identified teacher's beliefs and behaviors about technology use in the classroom. The researcher used this data to determine if there was a correlation between mindset in teachers and their beliefs and behaviors about technology use in the classroom. Four demographic questions were asked to determine major groups and sub groups used to analyze data. Two major groups are teachers who teach in one-to-one learning environments and teachers who do not teach in one-to-one learning environments. Subgroups included were the specific grade levels that the teachers taught.

To answer the first research question, the researcher created survey questions by identifying characteristics of an innovator's mindset which were determined by George Couros' book, *The Innovator's Mindset* (2015). The researcher was granted permission to use a list of potential teacher interview questions, created by Couros (2015), to identify if teacher candidates possess an innovator's mindset. Using the eight characteristics and interview questions, the researcher curated a series of questions that would lend themselves to determining if someone possessed the character traits of an innovators

mindset. A pool of these questions are provided in Appendix D. The final survey with the chosen questions from the pool are provided in Appendix E. Three questions from each characteristic were chosen at random to be included in the final survey. Not all questions were included in an effort to provide a survey that is reasonable in length. Lastly, a breakdown of the questions and what characteristic they represent are in Appendix F. To answer research question two, the researcher was given permission from the creators of the Teacher Technology Integration Survey (2009) to use a portion of the survey that measured beliefs and behaviors about technology in the classroom.

The final survey consisted of 31 questions. Twenty-seven of the survey items used a 5-point Likert scale to measure each characteristic of an innovator's mindset, teacher beliefs, engagement, and involvement. Participants read each statement and then selected whether they *Strongly Agree (4), Agree (3), Neutral (0), Disagree (2), Strongly Disagree (1).* Respondents answered four demographic questions. One survey item asked participants to select what grade level category they belong to, K-2 or 3-5. Another asked teachers to identify whether they taught in one-to-one learning environments or not. The third question asked respondents whether they were male or female. Lastly, participants identified how many years they have been the classroom.

Participants. Kindergarten through fifth grade elementary educators in the state of Missouri were asked to participate in the study. The study specifically focused on public school teachers at the elementary level. Considering the number of teachers in the state of Missouri, questionnaires were distributed to building administrators, via email, who then sent the link to the teacher survey to educators that the principal selected, in their buildings that met the following criteria:

- Participants must be a kindergarten through fifth grade elementary educator in a Missouri public school.
- The administrator should choose one lower (K-2) grade regular classroom teacher AND one upper grade (3-5) grade regular classroom teacher to be included in the survey.
- For the purposes of the study, all participants chosen should be regular classroom teachers that teach kindergarten through fifth grade.

Sample size. Research participants were chosen through a random sampling of at least 16 districts represented in the nine Regional Professional Development Centers (RPDC) in Missouri. After the quantitative data analysis, the researcher grouped the participants based on whether they taught in a classroom with one-to-one technologies available to their students or without one-to-one technologies available to their students. An effect size of 0.5 and a power of 0.8 is the typical standard for causal comparative studies. A sample size of at least 128 participants, with 64 in each group, was needed to achieve a medium effect size of 0.5 and a power of 0.8 (Heinrich, n.d.). The researcher ended up with a sample size of 137 respondents, 80 who reported having one-to-one learning environments and 57 who did not. A medium effect size of 0.5 was reached with a power of 0.81.

Consent. Participant consent was given by teacher completion of the online teacher survey for involvement in the study. Because the study focused on K-5 public elementary educators in the state of Missouri, participant confidentiality and any foreseen harm was outlined in the questionnaire as minimal. The questionnaire was not identifiable and teachers were informed that their participation and completion of the

survey were anonymous. In an effort to get as many responses as possible, a follow-up email was sent to building administrators asking them to send the ProQuest survey link again.

Approval. In accordance with the guidelines of Southwest Baptist University (SBU) regarding the protection of human participants, a request was submitted to the Research Review Board for approval to provide a survey for approximately 16 schools districts in each of the nine participating RPDC schools in this study. After receiving approval from the Research Review Board in March of 2019, participant recruitment and data collection began on a field test in order to gather validity and reliability of the questionnaire. Upon analyzing the data from the field test, questions were revised and the final questionnaire was created. The survey was then sent out to the represented participants.

Instrumentation

The following section reviews methods that the researcher used to measure validity and reliability. Face validity and content validity were tested prior to the researcher sending out the pilot survey. Details regarding the pilot survey and final survey are discussed. Finally, research methods are introduced and analyzed.

Validity and Reliability

Prior to dissemination of the questionnaire, the survey was tested for validity and reliability. Face validity, content validity, construct validity, and reliability were all a part of the piloting process prior to distributing the final questionnaire. Validity and reliability of the survey commenced once approval was granted by the Research Review Board.

Face validity. Face validity was conducted when creating the research questions to help determine if the survey questions measured what was intended by the research questions that led to creation of the survey (Salkind, 2010). The survey questions were reviewed for face validity by experts in the field of education. An expert panel of judges was exposed to individual survey items and were asked to identify each item as clearly representative, somewhat representative, or not representative of the construct of interest. The panel of judges were made up of four educators that were familiar with one-to-one learning environments and innovative mindset. The panel of judges concluded that survey items were clearly representative of characteristics of an innovators mindset and teacher beliefs about technology integration. The researcher was able to retain all survey items.

Content validity. Content validity ensures that the questions being asked in the survey are representative of the domain in which the questions are being asked (Salkind, 2010). Upon determining face validity of each survey item to see if it accurately represented each construct of interest within the survey, the researcher created a final survey, using three questions from each section that were clearly representative of the section of interest. The final survey was given to a panel of experts to determine if questions accurately measured innovative mindset in elementary school teachers and the beliefs and behaviors about classroom technology use. The panel of experts agreed that the items accurately measured the appropriate construct within the survey.

Pilot

Validity. The questionnaire was piloted to measure validity and reliability of the survey instrument. The survey was piloted in Springfield Public Schools by sixth and seventh grade teachers. The researcher followed the research guidelines as put forth by

the district which included providing chapters one through three and signatures from the researcher and the advisor of a completed proposal. Once permission was granted from the Analytics, Accountability, and Assessment department within Springfield Public Schools, the researcher sent an introductory email and survey link to sixth and seventh grade teachers within Springfield Public Schools. Based off the sample size of returned questionnaires, the survey items were measured for validity using factor analysis. Factor analysis is performed in order to determine if survey items measured the intended outcome and if they function as a group (Salkind, 2010). Principal component analysis was conducted to determine construct validity for innovative mindset (Questions 2, 7, 8, 9, 10, 14, 15, 20) and teacher technology beliefs (Questions 1, 5, 6, 17, 25, 26, 27, 29). Upon running principal component analysis, two additional constructs were identified in which the researcher had to name. The researcher determined that teacher engagement (Questions 4, 23, 24, 28) and teacher involvement (3, 12, 13, 19, 21, 22, 30) most accurately described the two additional constructs.

Reliability. Once each question in the survey instrument was tested for validity, additional tests to determine reliability of the questions in each section were measured. Cronbach's alpha was used to assess the consistency of how each survey item performed within the determined scale. Each construct had an alpha >0.7. Item-total correlations for each item were greater than 0.5. This ensures each question is measuring the same construct.

Final Survey

After analysis of the validity and reliability questions 11, 16, and 18 were excluded from the final survey because they did not meet Cronbach's alpha. The final

survey consisted of four demographic questions and 27 items to answer research questions one and two. The final survey consisted of 31 total items.

Data Analysis

This quantitative study was conducted in order to determine if there was a difference in innovative mindset in teachers in one-to-one learning environments and those that are not. Furthermore, the study sought to identify if there was a relationship between teacher mindset and their willingness to embrace technology. The data were analyzed using the SPSS software. An independent samples *t*-test was used to answer the first research question which determines whether there is a statistically significant difference in innovative mindset between teachers with one-to-one learning environments and those who are not. Typical *t*-test assumptions were checked before analyses were conducted. To answer the second research question, the researcher used a Pearson's correlation coefficient to determine if there was a relationship between teacher mindset and their willingness to embrace technology. Additionally, the researcher provided demographic data to give the reader a better understanding of the participants in the study.

Correlations between demographics and innovative mindset and teacher beliefs were explored. Teachers with one-to-one learning environments accounted for 80 respondents, 58%, of the total respondents. Teachers without one-to-one learning environments accounts for 57 respondents, 42%, of the total participants. The percentage of females who completed the survey was 91% as compared to this percentage of males 9%. K-2 teachers represented 52% of the total respondents while 3-5 teachers represented 48% of the total participants. Additionally, the researcher looked at years of experience in

the classroom and found that 35 teachers taught 0-5 years, 32 teachers taught 6-10 years, 27 teachers taught 11-15 years, and 43 teachers taught 16+ years.

In order to answer the first research question, data were analyzed using an independent samples *t*-test. An independent samples *t*-test was chosen to examine the first research question because it compares two unrelated groups (one-to-one learning environments vs. non one-to-one learning environments) using the same dependent variable (teacher's innovative mindset) (Salkind, 2010). The following assumptions were made in order to determine that the independent samples *t*-test the most valid test to be conducted on this research question:

- The dependent variable, teacher's innovative mindset, was measured on a continuous scale.
- The independent variables, teachers in one-to-one learning environments and teachers not in one-to-one learning environments, consisted of two categorical, independent groups.
- All research participants belong to only one group.
- The researcher assumes that there are no significant outliers.
- The dependent variable remained the same throughout the survey, for both independent variables being tested.

In order to answer the second research question, data were analyzed using a Pearson's correlation coefficient. The Pearson's correlation coefficient is the most appropriate test to answer the research question because it determines if there is a linear relationship between teacher mindset and teacher willingness to embrace technology

(Salkind, 2010). The following assumptions were made in order to determine that the Pearson's correlation coefficient is the most valid test to be ran on this research question:

- Each variable is continuous.
- Each observation has a pair of values—teacher mindset and willingness to embrace technology.
- There are no outliers in either variable.
- The scatterplot formed reveals linearity and homoscedasticity.

Summary

In Chapter Three the researcher outlined the methodology that was used in the study. The researcher presented the methods and materials that were used for data collection and the process by which data were collected and analyzed. A survey developed by the researcher was the methods of collecting the data used for the study. In Chapter Four the researcher will present the results of the study. The researcher discusses the findings of the research through the use of tables and quantitative analysis. In Chapter Five the researcher will review the completed study, present conclusions, discuss implications of this research for the field, and make recommendations for future research.

CHAPTER FOUR: ANALYSIS OF THE DATA

Introduction

The purpose of this quantitative study was to determine if one-to-one learning environments foster an innovative mindset in teachers as compared to teachers that do not teach in one-to-one learning environments. School districts have increasingly adopted one-to-one learning environments as an effort to develop twenty-first century skills in students. Kindergarten through fifth grade teachers at public elementary schools in the state of Missouri participated in the study in an effort to determine whether one-to-one learning environments foster an innovative mindset in teachers. A survey instrument gathered information from sample participants to address the research questions guiding the study.

In the next section, the sample used for this study and their demographics will be described. An overview of how data was cleaned and used for analysis will also be addressed. The research questions, null hypothesis, and tested assumptions will be provided to remind the reader of the goals of this study. In order to help describe the statistical tests conducted, tables for each research question will be provided. Statistical conclusions will also be provided for each research question.

In addition to answering the research questions, principal component analysis was ran on the pilot survey, which identified two other constructs, teacher involvement and

teacher engagement. An independent sample *t*-test was ran on the additional constructs to see if there was a difference in teachers with one-to-one learning environments and without one-to-one learning environments and teachers level of engagement or involvement. These tests were ran to provide better insight about one-to-one learning environments and are not a major part of the study.

The research questions are as follows:

1. What difference exists between teachers in one-to-one learning environments versus teachers not in one-to-one learning environments in terms of innovative mindset?
2. What is the relationship between a teacher's mindset and their attitude towards technology?

The following null hypotheses related to the research questions of the study existed:

H_{01}: There is no statistically significant difference between teachers in one-to-one learning environments and teachers not in one-to-one learning environments in innovative mindset.

H_{02}: There is no statistically significant relationship between teacher mindset and attitudes towards technology.

Data Analysis and Findings

Four survey items composed a demographic and background information section. The items allowed the researcher to create groups and subgroups for comparative purposes. Respondents identified themselves as male or female. Additionally, respondents identified how long they have been teaching and what grade level they currently teach. Lastly, participants selected whether they have one-to-one learning

environments or if they do not. The additional 27 survey items measured four constructs; innovative mindset (Questions 1, 5, 6, 15, 22, 23, 24, 26), teacher beliefs (Questions 2, 7, 8, 9, 10, 13, 14, 17), teacher involvement (Questions 3, 11, 12, 16, 18, 19, 27), and teacher engagement (Questions 4, 20, 21, 25).

After survey responses were collected, the number of respondents and their respective grade levels were analyzed. Table 1 reports the number of total respondents and the grade levels that they taught.

Table 1

Number of Responses per Grade Level

	Grades K-2	Grades 3-5
Number of Responses	71	66

Kindergarten through second grade teachers consisted of 71 out of 137 survey responses. Third through fifth grade teachers accounted for 66 of 137 completed surveys.

In order to answer the first research question, the researcher asked respondents to identify if they had one to one-to-one learning environments or if they did not. Table 2 reports the number of teachers that had one-to-one learning environments and teachers that did not have one-to-one learning environments.

Table 2

Number of Respondents with or without One-to-One Learning Environments

	One-to-One	Not One-to-One
Number of Responses	80	57

Eighty teachers, 58%, reported that they had one-to-one learning environments. Fifty-seven teachers, 42%, reported that they do not have one-to-one learning environments. Ninety-one percent of teachers were female.

An additional item that the researcher analyzed was the number of years that respondents have been in education. Table 3 shows the total number of participants and the years that they have been in education.

Table 3

Number of Teachers per Years in Education

	0-5 years	6-10 years	11-15 years	16+ years
Number of Teachers	35	32	27	43

Teachers reported a range for the number of years they have been in education. Thirty-five, 26%, have taught 0-5 years; thirty-two teachers, 23%, reported teaching 6-10 years; twenty-seven teachers, 20%, said they have been in the classroom from 11-15 years; and 43 teachers, 31%, have taught for 16 or more years.

Participants took the survey in QuestionPro. After the conclusion of the survey, data were downloaded and integrated into SPSS data sets. The researcher retained all survey responses for data analysis. The responses for all items contributing to each of the four survey constructs was combined to create a statistical mean for each construct. Data cleaning was limited to the default SPSS software settings to exclude missing values. Since the researcher required a response to each survey item, there were no missing values. Descriptive statistics utilized pairwise exclusion of missing values.

Supporting Research Question 1

This section provides the findings of the first research question. The first research question asked if a difference exists between teachers in one-to-one learning environments versus teachers not in one-to-one learning environments in terms of innovative mindset. The researcher used an independent samples *t*-test to determine if

there was a statistically significant difference between teachers that have one-to-one learning environments and teachers that do not have one-to-one learning environments and innovative mindset.

Table 4 shows the results of teachers with one-to-one learning environments, along with the mean and standard deviation for innovative mindset. Additionally, the table tells you the number of teachers who do not have one-to-one learning environments, the mean, and standard deviation.

Table 4

Number of Respondents, Mean, and Standard Deviation on Innovative Mindset

One-to-one	*N*	*M*	*SD*
Yes	80	4.45	0.39
No	57	4.32	0.39

The researcher acquired 137 completed survey responses from K-5 public school teachers in the state of Missouri. Eighty teachers, 58%, reported that they had one-to-one learning environments. Fifty-seven teachers, 42%, reported that they do not have one-to-one learning environments. Teachers with one-to-one learning environments fostered more of an innovative mindset ($M = 4.45$, $SD = 0.39$) than teachers without one-to-one learning environments ($M = 4.32$, $SD = 0.39$). The mean tells us that the average answer from participants was between agree (4) and strongly agree (5). A standard deviation of 0.39 indicates that the mean is representative the data. Standard deviation gives us an idea of how well the mean represents the data. The larger the standard deviation, the mean is less representative of the data. The smaller the standard deviation, the mean better represents the data.

There was homogeneity of variances for innovative mindset scores for teachers with one-to-one technology and those without, as assessed by Levene's test for equality of variances *(p* = .741). Equality of variances indicates that the two samples are equal. The mean score of teachers with one-to-one learning environments was 0.12, 95% CI [-0.02 to 0.26] higher than those without one-to-one learning environments.

Table 5 reports the findings of an independent samples *t*-test that was ran in order to answer research question 1. The independent samples *t*-test measured teachers with and without one-to-one learning environments on innovative mindset.

Table 5

Independent Samples t-test on Innovative Mindset

	t	*df*	*p*
Innovative Mindset	1.75	135	0.083

There was not a statistically significant difference in mean innovative mindset scores between teachers with one-to-one learning environments and teachers without one-to-one learning environments, t (135) =1.749, p = .083, d=0.76. A t-value of 1.75 means that the two groups are 1.75 times different from each other as they are within each other. The higher the t-value, the more likely it is that the results are repeatable. The lower the p-value, the higher probability that the data did not occur by chance. There was not a statistically significant difference between means ($p > .05$); therefore, we can fail to reject the null hypothesis.

Supporting Research Question 2

In addition to seeing if one-to-one learning environments fostered an innovative mindset in teachers, the researcher also wanted to know if there was a relationship between a teacher's mindset and their attitude towards technology. To answer the second

research question, the researcher conducted a Pearson's correlation coefficient. The findings of the Pearson correlation coefficient are below.

Table 6 represents the results of the Pearson's correlation coefficient to determine if there was a relationship between a teacher's mindset and their beliefs about technology.

Table 6

Pearson's correlation coefficient between Innovative Mindset and Teacher Beliefs

		Innovative Mindset	Teacher Beliefs
Innovative Mindset	Pearson Correlation	1	.688**
	Sig. (2-tailed)		.000
	N	137	137
Teacher Beliefs	Pearson Correlation	.688**	1
	Sig. (2-tailed)	.000	
	N	137	137

**Correlation is significant at .01 level (2-tailed)

There was a strong correlation between teacher beliefs about technology and innovative mindset, r (135) = .69. There was a strong correlation between teacher beliefs about technology integration and innovative mindset because there is a positive association that is closer to 1. The closer the coefficient is to zero, the lesser the association between the two variables. The closer the coefficient is to 1, the stronger the association between the two variables. Teacher's beliefs about technology explained 47% of the variability in innovative mindset. A Pearson's product-moment correlation was run to assess the relationship between teacher beliefs about technology integration and innovative mindset. Preliminary analyses showed the relationship to be linear with both variables normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$), and there were no outliers. There was a statistically significant, strong positive correlation between

teacher beliefs about technology integration and innovative mindset. Therefore, we can reject the null hypothesis and accept the alternative hypothesis.

Introduction to Additional Constructs

The following constructs were added to the study after principal component analysis was ran, which determined that the survey best represented four constructs. Two of the constructs represented the research questions in the study, innovative mindset (Questions 2, 7, 8, 9, 10, 14, 15, 20) and teacher technology beliefs (Questions 1, 5, 6, 17, 25, 26, 27, 29). Two additional constructs were identified in which the researcher had to name. The researcher determined that teacher engagement (Questions 4, 23, 24, 28) and teacher involvement (3, 12, 13, 19, 21, 22, 30) most accurately described the two additional constructs. The researcher ran an independent samples *t*-test on the two added constructs to determine differences in teacher involvement and teacher engagement of teachers with one-to-one learning environments and without one-to-one learning environments. The results of the independent samples *t*-test for each construct is below.

Supporting Teacher Involvement

An independent samples *t*-test was run to determine differences in involvement levels in teachers with one-to-one learning environments as opposed to those who do not have one-to-one learning environments. The researcher ran the Explore procedure in SPSS to determine if there were outliers in any of the groups. Upon running the analysis, an inspection of a boxplot revealed outliers. Three of the outliers are within 1.5 interquartile range. One outlier is an extreme outlier because it is three interquartile ranges beyond the desired range. Since this is based on a scale from one to five, the

outliers do not alter the means extensively. Therefore, the researcher chose to keep the outliers as a part of the research and continue with the independent samples *t*-test.

The independent samples *t*-test was conducted to determine differences in teacher involvement of teachers with one-to-one learning environments and without one-to-one learning environments. Table 7 outlines the number of participants in the survey, mean, and the standard deviation.

Table 7

Number of Respondents, Mean, and Standard Deviation on Involvement

One-to-one	N	Mean	SD
Yes	80	3.87	0.48
No	57	3.77	0.52

Teacher involvement scores for one-to-one learning environments were normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$). There were 80 teachers or 58% that reported having one-to-one learning environments. Fifty-seven teachers, representing 42% of the sample size that reported that they did not have one-to-one learning environments. Teachers with one-to-one learning environments were more involved (M =3.87, SD = 0.48) than teachers without one-to-one learning environments (M = 3.77, SD = 0.52).

Together, the mean and standard deviation reveal to us that teachers with one-to-one learning environments were more involved than teachers that do not have one-to-one learning environments. Table 8 takes this a step further by showing the results of the independent samples *t*-test to determine if there is a statistically significant difference in involvement of teachers with one-to-one learning environments and teachers without one-to-one learning environments.

Table 8

Independent Samples t-test on Involvement

	t	*df*	*p*
Involvement	1.14	135	0.255

There was homogeneity of variances, as assessed by Levene's test for equality of variances (p = .76). Teachers with one-to-one learning environments score was 0.26, 95% CI [-0.07 to 0.27] higher than teachers without one-to-one learning environments. While the mean and standard deviation indicate that teachers with one-to-one learning environments are more involved than teachers without, there was not a statistically significant difference in involvement of teachers with one-to-one learning environments and teachers without one-to-one learning environments, t (135) =1.142, p = .099.

Supporting Teacher Engagement

The independent samples *t*-test was conducted to determine differences in teacher engagement of teachers with one-to-one learning environments and without one-to-one learning environments. Table 9 outlines the number of participants in the survey, mean, and the standard deviation.

Table 9

Number of Respondents, Mean, and Standard Deviation on Engagement

One-to-one	N	Mean	*SD*
Yes	80	4.35	0.39
No	57	4.26	0.46

There were no outliers. There were 80 teachers with one-to-one learning environments and 57 not in one-to-one learning environments. Teachers with one-to-one learning environments are more engaged (M = 4.35, SD = 0.39) than teachers without one-to-one learning environments (M = 4.26, SD = 0.45).

The mean and standard deviation reveal to us that teachers with one-to-one learning environments were more engaged than teachers that do not have one-to-one learning environments. Table 10 shows the results of the independent samples *t*-test to determine if there is a statistically significant difference in involvement of teachers with one-to-one learning environments and teachers without one-to-one learning environments.

Table 10

Independent Samples t-test on Engagement

	t	*df*	*p*
Engagement	1.198	135	0.233

There was homogeneity of variances for engagement scores teachers with one-to-one learning environments and without one-to-one learning environments, as assessed by Levene's test for equality of variances (p = .228). Teachers with one-to-one learning environments. Teacher's with one-to-one learning environments engagement score was 0.09, 95% CI [-0.07 to 0.23] higher than teacher's without one-to-one learning environments mean engagement score. There was not a statistically significant difference in mean engagement scores between teachers with one-to-one learning environments and teachers without one-to-one learning environments, t (135) = 1.198, p = .087.

Summary

This chapter presented results of the survey analysis relating to the research questions guiding the study. An independent samples *t*-test was ran on innovative mindset and were analyzed for statistically significant responses for both teachers with one-to-one learning environments and teachers without one-to-one learning environments. There was not a statistically significant difference in mean innovative

mindset scores between teachers with one-to-one learning environments and teachers without one-to-one learning environments, t (135) =1.749, p = .083. A Pearson's correlation coefficient determined if there was a statistically significant relationship between teacher's beliefs about technology integration and their mindset. Independent samples t-test was ran on the additional constructs to see if there was a difference in teachers with one-to-one learning environments and without one-to-one learning environments and teachers level of engagement or involvement. There was a statistically significant, strong positive correlation between teacher beliefs about technology integration and innovative mindset, r (137) = .69, p < .001, with teacher beliefs about technology integration explaining 47% of the variation in innovative mindset. These tests were run to provide better insight about one-to-one learning environments and are not a major part of the study. Chapter Five presents a summary of the study, which includes interpretation of research results, implication of the results, and recommendations for future research.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

Introduction

American students of the twenty-first century have grown up with Internet accessible technology, therefore, the education system should provide equitable access to students in order to prepare them for the workforce they will enter (Battelle for Kids, 2019; Medlin, 2016). One-way that educational organizations can provide equitable access to twenty-first century skills is to focus on each child's individual abilities and interests at an early age (Medlin, 2016). Their individual abilities and interests can be defined as a broad set of knowledge, skills, work habits, and character traits believed to be critically important to success in today's world (Medlin, 2016). Educational organizations are embracing these skills and ensuring that students have equitable access to a twenty-first century education by providing students with one-to-one learning environments (Gallemore, 2017; Medlin, 2016).

The United States Department of Education makes educators aware of the need to leverage technology in their classrooms to provide more meaningful and authentic learning opportunities for students (National Education Technology Plan, 2016). Studies suggest that one-to-one learning environments increase student engagement and that students enjoy using multimedia, searching the Internet, and writing papers on their computer (Bebell & O'Dwyer, 2010; Suhr, Hernandez, Grimes, & Warschauer, 2010). In order for one-to-one learning environments to be successful there must be buy-in from teachers (Bebell & O'Dwyer, 2010). Bebell and O'Dwyer (2010) suggests that buy-in from teachers for tech immersion is critically important because students' school experiences with technology are largely dictated by their teachers. Unless educators

bridge the gap between how students live and how students learn, today's education system will continue to face irrelevance (Battelle for Kids, 2019). This is important to consider, as we are well into the twenty-first century and many public schools have not yet embraced all components of twenty-first century skills (Mills, 2016).

The twenty-first century has allowed American students to grow up with Internet accessible technology in their everyday activities (Medlin, 2016). This high level of engagement with technology indicates a need for the re-evaluation of instructional pedagogies and content being used in an educational institution in order to meet the needs of today's students (Chandrasekhar, 2009; Prensky, 2001). Herbert (2006) makes us aware that while educational organizations are essential in the development of creativity and innovation, there remains a profound gap between the knowledge and skills most students learn in school and the knowledge and skills they will need to possess in typical twenty-first century communities and workplaces. Knowing that employees must demonstrate innovative behavior within their organization in order to compete in a highly competitive market, education is crucial in developing creative and innovative thinking in students so that they may be successful in the job market (Andiliou & Murphy, 2010; Mingus, 2014; Wagner, 2010). In an effort to bridge this skills gap, educational institutions are bringing technology into the organization (Mills, 2016).

The purpose of this research study was to determine if one-to-one learning environments foster an innovative mindset in teachers as compared to teachers that do not teach in one-to-one learning environments. This study also examined if there was a relationship between teacher's beliefs about technology integration and their mindset. Since educational organizations are equipping students with one-to-one learning

environments in an effort to provide equitable access to a twenty-first century education (Gallemore, 2017; Medlin, 2016), the study provides leaders with knowledge about whether one-to-one learning environments foster an innovative mindset in teachers. Furthermore, the study provides insight into the professional development that might be needed to produce teacher buy-in and form positive beliefs about technology integration in the classroom. It also aims to support the body of current research in support of implementing one-to-one learning environments into educational organizations.

At the beginning of the chapter, the researcher summarized the purpose of the study. Throughout the rest of the chapter, the researcher tells readers what the findings of the study were and hopes to provide understanding for the findings through discussion. Later, implications for professional practice and education are given as they tie back to the literature review. Lastly, recommendations for future research to expand the results of this study were offered.

Findings and Discussion

The following sections discuss the findings for each research question followed by a discussion for each research question. The findings analyze the results of each research question and construct. The discussion describes outcomes of the results as it relates to the researcher's professional experience and literature review.

Findings for research question 1. The first research question asked if a difference exists between teachers in one-to-one learning environments versus teachers not in one-to-one learning environments in terms of innovative mindset. The researcher hypothesized that there is no statistically significant difference between teachers in one-to-one learning environments and teachers not in one-to-one learning environments in

fostering an innovative mindset. After running an independent samples *t*-test, the results were analyzed and revealed that there was not a statistically significant difference in mean innovative mindset scores between teachers with one-to-one learning environments and teachers without one-to-one learning environments, $t(135) = 1.749$, $p = .083$, $d = 0.76$. There was not a statistically significant difference between means ($p > .05$); therefore, we can fail to reject the null hypothesis. The results for teachers in one-to-one learning environments fostering an innovative mindset skewed toward *agree*. The mean for the items ranged from 3.50-5.00. The data indicated greater agreement in innovative mindset with teachers that had one-to-one learning environments versus teachers without one-to-one learning environments, within 3% of the 5% cutoff level from achieving statistical significance.

Discussion for research question 1. Even though the results of the data failed to reject the null hypothesis, the results were only 3% away from the 5% cutoff needed to be statistically significant. This is important because teachers with one-to-one learning environments are more innovative than teachers without one-to-one learning environments. From my professional experience as a Blended Learning Specialist who supported our districts teaching and learning initiative, it is apparent and not surprising that teachers with one-to-one learning environments have the ability to be more innovative in the lessons that they create for students due to the door that the technology opens up for teachers and their students via the Internet. While I believe that technology can certainly open up the doors for teachers to be innovative in their practices, the one-to-one learning environment is not what makes the teacher more innovative in and of itself. My experience, along with this research, has proven that teachers have to have a growth

mindset before they can hope to implement one-to-one learning environments purposefully. Teachers that embrace one-to-one learning environments are in fact teachers that are excited about learning themselves.

The first research question is important for us to consider because it supports the idea and current research around districts implementing one-to-one learning environments. Educational organizations are adopting one-to-one learning environments in an effort to help students develop twenty-first century skills so that they are prepared for the workforce (Gallemore, 2017; Medlin, 2016). Districts should continue with implementation as the research skews towards creating teachers that are more innovative which leads to students being more innovative—an important characteristic of finding success in the twenty-first century.

Additionally, this research supports the work of Couros (2015) who says that, "The growth mindset is crucial in one's openness to learning. But to change education and prepare students for their futures, we need to adopt an innovator's mindset for ourselves and instill this mindset in our students" (p. 33). One-to-one learning environments have the ability to change a teacher's mindset to be more innovative for students, thus creating more opportunities for students to develop twenty-first century skills.

Also, one-to-one learning environments allow for a more constructivist approach to student learning. Allsop (2016) asserts that constructivist classrooms allow opportunities for students to foster twenty-first century skills. John Dewey believed that knowledge obtained at school should be able to extend to students worlds outside of school (Allsop, 2016). One-to-one learning environments are able to extend the

opportunities beyond classroom walls when teachers provide authentic experiences with devices for students to collaborate and engage with technology. Many studies have been done around the constructivist classroom and twenty-first century skills, all of which agree on one outcome—when a constructivist classroom meets the knowledge and skills that students need in today's society, there is a positive impact on student learning (Allsop, 2016).

Supporting research question 2. The second research question sought to determine if there was a relationship between a teacher's mindset and their attitude towards technology. There was a statistically significant, r (135) = .69, strong positive correlation between teacher beliefs about technology integration and innovative mindset. Therefore, the researcher rejected the null hypothesis and accepted the alternative hypothesis. The mean for teacher's mindset ranged from 3.5-5.0 and skewed toward *agree*. The mean for teacher attitudes towards technology ranged from 2.5-5.0 and skewed toward *agree*.

Discussion for research question 2. The research showed a strong relationship between a teacher's mindset and their attitude towards technology. This supports Dweck's (2006) work around a fixed and growth mindset. Teachers that exhibit a fixed mindset on technology integration in the classroom, may foster some characteristics of an innovator's mindset, but overall will not be more innovative in the opportunities they provide students because their attitude towards technology is negative. However, if a teacher has a growth mindset on technology integration in the classroom, they will also have some characteristics of an innovators mindset. The difference between the two is that teachers with a fixed mindset have a negative view about technology integration and

teachers with a growth mindset have a positive view about technology integration and are willing to learn. Teachers with a growth mindset believe that not only they can learn, but that their students can learn. It is so important for educators to be given professional development opportunities around growth mindset and technology integration because student achievement depends on it. Rheinberg's (1983) research proves that when teachers have a growth mindset, students have higher achievement results than students who were taught by a teacher with a fixed mindset. So, given this relationship between teachers' attitudes and beliefs about technology integration, the challenge presents itself to educators in how to change teachers' fixed mindsets so that all students can be given equal opportunities in one-to-one learning environments to develop twenty-first century skills so that they are prepared for the workforce.

In my work of supporting one-to-one learning environments over the past 5 years, I have seen many teachers who had negative views of technology with a fixed mindset. Over the years, the district has offered multiple professional development opportunities for teachers to learn how to embrace one-to-one technology and using it to develop twenty-first century skills. What I have learned is that teachers usually have a fixed mindset about something due to fear of not knowing. Educators face resistance due to fear of the unknown. With the rapid pace of technology advancement, many educators did not grow up with Internet accessible technology and therefore, do not feel comfortable using it. Over time, as teachers have opportunities to learn and to practice, I have seen them become more comfortable with the devices and have seen their mindset change from fixed to growth regarding technology integration. They begin to see the value in one-to-one learning environments and how these spaces create many ways for

students to be creative, collaborate, and communicate around real world problems that they are interested in.

Supporting teacher involvement. Construct 3 became a part of the study when the researcher ran principal component analysis that identified teacher involvement. In this study, teacher involvement referred to the extent to which teachers reflected on their practice and provided opportunities for students to build twenty-first century skills. The research showed that teachers with one-to-one learning environments were more involved (M = 3.87, SD = 0.48) than teachers without one-to-one learning environments (M = 3.77, SD = 0.52). Teachers with one-to-one learning environments score was 0.26, 95% CI [-0.07 to 0.27] higher than teachers without one-to-one learning environments. There was not a statistically significant difference in involvement of teachers with one-to-one learning environments and teachers without one-to-one learning environments, t (135) =1.142, p = .099.

Discussion for teacher involvement. Since this construct on teacher involvement was not originally apart of the study, the researcher did not include specific literature on this topic. However, questions asked on the survey were representative of teachers and students being reflective practitioners, taking risks when solving real-world problems to build resilience, and teachers providing students with opportunities to connect with their classmates, their community, and others around the world. Couros' (2015) work on innovative mindset supports this construct as he talks about characteristics such as reflection, problem-solving, risk-taking, resiliency, and connectedness (networks). First, reflection is the process of innovation development and is a necessary task in innovation (Couros, 2015; Messman & Mulder, 2012). K-12 teachers are expected to take a

reflective approach to their practice and seek ways of being more effective at engaging their students and offering progressive curriculum and instruction (Loughran, 2002; Nadelson & Seifert, 2016). Second, the Framework for Twenty-First Century Learning has included problem solving as an essential skill that our students need to find success in the twenty-first century (Battelle for Kids, 2019). Teachers with one-to-one learning environments are more involved than teachers without one-to-one learning environments. Being a problem finder/solver is providing students with opportunities to be self-starters and to continually reflect on how they might improve their education to effectively learn (Couros, 2015). Third, taking risks is important for students because it allows the willingness to make mistakes, advocate unpopular positions or tackle extremely challenging problems without obvious solutions so that one's personal growth, integrity and accomplishments are enhanced. Resiliency must be a skill teachers and students cultivate when being innovative since innovative requires ideas to be challenged in order to come up with new and better ideas. Lastly, Couros (2015) says that networks are crucial to innovation. The power of belonging to networks is sharing ideas, clarifying our thinking, and developing new and better ideas (Boholano, 2017; Couros, 2015).

Construct 3 best represented the term "teacher involvement" because the survey questions lend themselves to a teacher constantly being reflective in order to provide students with opportunities to develop characteristics of someone with an innovator's mindset. Teacher involvement became an important topic to this study because one-to-one learning environments demand that teachers are intentional about the opportunities they are providing students to cultivate skills of the twenty-first century while meeting mastery of curriculum standards.

Supporting teacher engagement. Like Construct Three, Construct 4 was not originally part of the study. The researcher ran principal component analysis that identified the fourth construct, teacher engagement. For the purposes of this study, the researcher defined teacher engagement as the extent to which a teacher differentiates his or her classroom to create personal, relevant, and engaging experiences for all students. An example of an engaged teacher is one who knows her students' passions and interests and pulls those into her daily lessons. After running an independent samples *t*-test, the researcher found that teachers with one-to-one learning environments are more engaged (M = 4.35, SD = 0.39) than teachers without one-to-one learning environments (M = 4.26, SD = 0.45). Teacher's with one-to-one learning environments engagement score was 0.09, 95% CI [-0.07 to 0.23] higher than teacher's without one-to-one learning environments mean engagement score. While there was not a statistically significant difference in mean teacher engagement scores between teachers with one-to-one learning environments and teachers without one-to-one learning environments, t (135) = 1.198, p = .087. Therefore, further research could indicate that teachers with one-to-one learning environments are more engaged versus teachers that do not have one-to-one learning environments.

Discussion for teacher engagement. Similar to teacher involvement, teacher engagement was not originally apart of the study, thus there is not a specific part of the literature about teacher engagement. The questions on teacher engagement were about forming relationships with students and knowing them well enough to tap into their passions and interests in order to create engaging learning experiences for students. This calls teachers to be observant, a characteristic of someone with an innovator's mindset.

An educator who is observant recognizes the importance of forming networks with people across the world and using those connections in order to come up with ideas for crafting quality lessons. Teacher engagement also includes that teachers be creative, another characteristic of someone with an innovator's mindset, in their approach to designing lessons that meet standards and students' interests. Creation is crucial because it allows students to make personal connections to information, which is an important key for deeper learning (Couros, 2015). Lastly, teacher engagement requires that teachers are empathetic to their students. This means that they are able to put themselves in their students shoes and ask questions like, "How will this impact my students?" or "How will this make them feel?" or "Is this lesson relevant to my students?". An empathetic educator is one who puts him/herself into the shoes of the student and creates a classroom environment and learning environments that allow students to interact with content in a meaningful way (Couros, 2015). Teacher engagement best represented the fourth and final construct because the nature of the survey questions lent themselves to teachers that genuinely interact with their students in order to create lessons that engage. Lastly, studies suggest that one-to-one learning environments increase student engagement and that students enjoy using multimedia, searching the Internet, and writing papers on their computer (Bebell & O'Dwyer, 2010; Suhr, Hernandez, Grimes, & Warschauer, 2010).

Implications for Professional Practice

The following section provides conclusions for how professionals in the field of education might take the research from this study and use it to drive professional development in their educational organization. Teacher engagement and teacher involvement were combined because the same conclusions were made about each

construct. The researcher then talks about innovative mindset and teacher beliefs about technology integration because they went hand-in-hand.

Teacher involvement and teacher engagement

Teacher involvement and teacher engagement were not originally part of the study and were identified and added after principal component analysis was ran. Teachers in one-to-one learning environments are more likely to be involved, or willing to reflect and provide their students opportunities to build twenty-first century skills than teachers that do not have one-to-one learning environments. Engaged teachers are teachers that differentiate within their classrooms to provide personal, relevant, and engaging experiences for students. Teachers with one-to-one learning environments are more engaged than teachers who are in traditional classrooms. While not a part of the original study, both constructs provide educators key insights into how they might leverage professional learning around one-to-one learning environments in order to increase teacher involvement and teacher engagement.

Districts can provide professional learning opportunities to their staff in order to increase teacher involvement and teacher engagement when thinking about the integration of one-to-one learning environments in the classroom. First, districts must provide professional learning on how to use the devices, as well as, technology tools that teachers can use to make more meaningful connections to the content. In addition to professional development around technology, teachers should be given multiple opportunities to practice using the technology and given ample time to think about ways to properly blend the use of technology tools with their curriculum to enhance the learning environment for students. Additionally, teachers should be given opportunities to

collaborate with grade-level peers on a regular basis to share ideas on how they might integrate technology into their curriculum and to be reflective of ways they have previously used technology to enhance instruction. In fact, K-12 teachers are expected to be reflective in their practice and seek ways of being more effective at engaging their students and offering progressive curriculum and instruction (Loughran, 2002; Nadelson & Seifert, 2016). Trilling and Fadel (2009) support the creation of professional development that exploits twenty-first century learning and innovates how teachers learn through inquiry, design, and collaborative approaches in order to build a strong community of professional educators. Without affording teachers the opportunity to learn, collaborate about technology integration and reflect, you will not get buy-in from teachers. Bebell and O'Dwyer (2010) say that in order for one-to-one learning environments to be successful, you must have buy-in from teachers. Additionally, teachers that embrace twenty-first century learning environments, create opportunities for themselves and their students to be innovative (Trilling & Fadel, 2009). If educational organizations hope to have teachers that are involved and engaged in their one-to-one learning environments, then they must get teachers to buy-in to the importance of the devices and these new learning environments. The National Association of Elementary School Principals (2012) suggests that a progressive technology-infused campus is not about money but about the mindset of all stakeholders within the campus. Educational organizations must adopt a mindset that allows for us to welcome new challenges, embrace change, and be a risk-taker (Couros, 2015).

Teacher technology beliefs about technology integration and innovative mindset

Educators should be aware that as teachers gain confidence with the use of technology in their classroom, it is likely that their beliefs about technology integration along with their mindset will shift. The second research question in this study revealed that teachers who believe in technology integration demonstrate more of an innovative mindset than teachers who do not believe in technology integration. This finding was not surprising since Chandrasekhar (2009), Windschitl and Sahl (2002), and Schaumberg (2001) claim that teacher belief systems and attitudes play a critical role in the effective implementation of any innovative strategy. Because we know that the mindset of all stakeholders is important for one-to-one learning environments to be successful, educators should provide teachers with professional learning. Trilling and Fadel (2009) support the creation of professional development that executes twenty-first century learning and innovates how teachers learn through inquiry, design, and collaborative approaches in order to build a strong community of professional educators.

Some ways that districts might provide this professional development is by providing optional after school trainings led by district and teacher leaders highlighting certain tools. Building administrators might consider hosting a "Tech Tuesday" after school for teachers in the building to showcase how they are purposely using technology to create engaging learning experiences for kids. Also, administrators could highlight what is happening in their building by taking pictures of technology integration throughout the week and posting them in a section of their newsletter for teachers to see. It is recommended that educational organizations invest in hiring technology specialists

that can support teachers and administrators in technology integration. Administrators should lean into their instructional coaches, if available, to also provide support in the implementation of technology. Additionally, administrators should encourage teachers to grow their professional learning networks for continued growth and learning. Couros (2015) says that networking is crucial to innovation. By providing teachers with professional development on technology integration, educational organizations will create or foster teacher buy-in which is necessary for one-to-one learning environments to be successful. When teachers have buy-in, they believe in the work they are doing, therefore, teachers tend to be more innovative. Teachers that are innovative provide opportunities for students to develop necessary skills that students will need to be successful outside of the classroom.

Since teachers' beliefs about tech integration lend themselves to having an innovative mindset then it is important that we get teachers to believe in the technology. It is important that educators get teachers to buy-in to the implementation of one-to-one learning environments. Educators will get teachers to buy-in to the technology by providing professional development. When teachers believe in the technology, their mindset will also change. Teachers that demonstrate an innovative mindset also believe in technology integration. Auten (2013) and Mills (2016) say that a growth mindset is essential to teaching twenty-first century skills to students as well as implementing twenty-first century learning environments. In addition to stating that a growth mindset is a necessity in implementing twenty-first century learning environments, Mills (2016) research revealed that teachers who were successfully implementing twenty-first century learning environments fostered many characteristics of an innovator's mindset. In order

to prepare students for the twenty-first century, educators must have an innovator's mindset (Couros, 2015).

Implications on Education

Thirty percent of our country's current workforce is made of creative industries and is continuing to grow rapidly (Herbert, 2006). In order for businesses to remain competitive, they need to employ people who are able to be creative and innovative (Andilou & Murphy, 2010; Ferrari et al., 2009). Dillon (2006) says that in an economy where the creation of knowledge is replacing the creation of products, the ability to breathe life into ideas, solve difficult problems, and dissect complex issues becomes an attribute that is critical to develop. Therefore, education is viewed as critical in developing creative and innovative skills in students. Additionally, the rapid pace of technology growth attributes to the need for businesses to be more innovative than ever before. Technological change is driven by human creativity, and technology provides new contexts and tools for creative output. Due to this reciprocal relationship between creativity and technology, teaching and learning must emphasize their connection (Henricksen et al., 2016). Therefore, when educators are able to embrace a creative mindset and understand the ways in which technology can present content creatively, they have the power to unlock students' creative and innovative potential (Henriksen et al., 2016).

While there was not a statistically significant difference in teachers that have one-to-one learning environments and innovative mindset, research did indicate that teachers in one-to-one learning environments foster more of an innovative mindset than teachers not in one-to-one learning environments. The research also suggests that teachers, who

believe in technology integration, also have characteristics of an innovator's mindset. This is important for educational organizations to consider because teachers that foster an innovative mindset are able to provide more opportunities for students to develop creative and innovative skills while utilizing technology. Since technology is continuing to grow and allows opportunities for us to be more connected than ever before, districts should continue to provide students with one-to-one learning environments in order to foster twenty-first century skills. When we emphasize the connection between technology beliefs and mindset, districts must be prepared to build teacher capacity around the importance of teaching students twenty-first century skills. Professional development on the twenty-first century skills, ISTE Standards for Education, and devices in the classroom should be provided regularly to build teacher efficacy.

Recommendations for Future Research

Future research should be conducted to better understand how one-to-one learning environments might foster an innovative mindset in teachers. The study should be replicated with teachers at middle and high school levels. Methodologies in which research was done with school districts in other states would refine the results of this study. Methodologies capturing specific grade levels with one-to-one learning environments, rather than reported ranges, would contribute to the objectivity of the results. Mechanisms for sampling a greater percentage of the teacher population would enhance the generalizability of results. The addition of qualitative methods to explore factors underlying teacher perceptions on innovative mindset and beliefs about technology integration would also expand the study.

The study should be replicated to research teacher beliefs around technology integration and mindset. The Teacher Beliefs about Technology Integration construct items could be amended to measure perceptions about teacher beliefs about technology integration and mindset. The researcher recommends that validity and reliability testing be repeated before amended survey items are used. Future studies could include an additional demographic question on whether the teacher holds an educational technology degree to determine if that has an influence on teacher beliefs about technology integration, innovative mindset, and one-to-one learning environments.

Summary

The focus of this study was on whether one-to-one learning environments foster an innovative mindset in teachers. The research question that was used for this focus was: What difference exists between teachers in one-to-one learning environments versus teachers not in one-to-one learning environments in terms of innovative mindset? After running an independent samples *t*-test, the results were analyzed and revealed that there was not a statistically significant difference in mean innovative mindset scores between teachers with one-to-one learning environments and teachers without one-to-one learning environments, t (135) =1.749, p = .083, d=0.76. This study also examined relationships that might exist between a teacher's mindset and their beliefs about technology integration. The second research question stated: What is the relationship between a teacher's mindset and their attitude towards technology? There was a strong correlation between teacher beliefs about technology and innovative mindset, r (135) = .69.

One-to-one learning environments support the constructivist approach because it provides students opportunities to construct their own knowledge based on prior

experiences and the many opportunities to connect with others across the world in a matter of seconds. Many studies have been done around the constructivist classroom and twenty-first century skills, all of which agree on one outcome—when a constructivist classroom meets the knowledge and skills that students need in today's society, there is a positive impact on student learning (Allsop, 2016). A constructivist approach to learning requires teachers to foster a growth mindset because it demands that teachers and students believe that they are the constructors of their own knowledge and are able to grow and learn. Dweck (2006) and Rheinberg (1983) research agrees that a growth mindset in students and teachers has a positive impact on overall student achievement. Couros (2016) believes that in addition to having a growth mindset so that educators can learn, they must also have an innovators mindset. An innovators mindset is important in this day and age due to the rapid rate of globalization and the need for businesses to more innovative. Teachers and students need to be innovative in the twenty-first century because our workforce is competitive and our students are competing with other nations for jobs. Innovation is created when educators place an emphasis on teaching students core content knowledge along with other twenty-first century skills like technology and the 4C's. Battelle for Kids (2019) states:

> Twenty-first century learning environments and opportunities are essential to prepare all students for the challenges of work, life, and citizenship in the 21st century and beyond, as well as ensure ongoing innovation in our economy and the health of our democracy" (Battelle for Kids, 2019, para. 1).

There is currently little to no research on the innovative mindset. This study supported Couros (2015) work by reiterating the importance of the eight characteristics of someone

with an innovator's mindset. It also supports research completed on one-to-one learning environments and their importance for developing twenty-first century skills in students. This study intended to contribute to the field of education by producing a survey that can measure innovative mindset in teachers, teacher mindset and teacher beliefs about technology integration, teacher involvement, and teacher engagement. Mostly, the researcher hopes to provide others with ways to support teachers in one-to-one learning environments as well as ways educators can shift teachers' mindsets in order to teach students twenty-first century skills.

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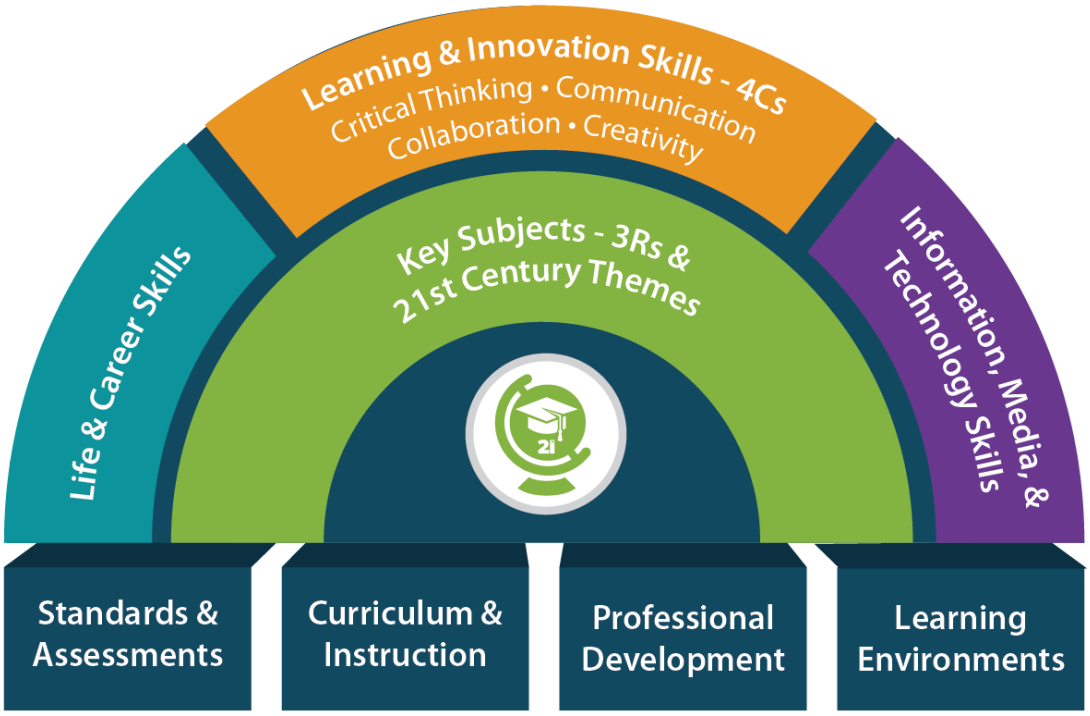
APPENDIXES

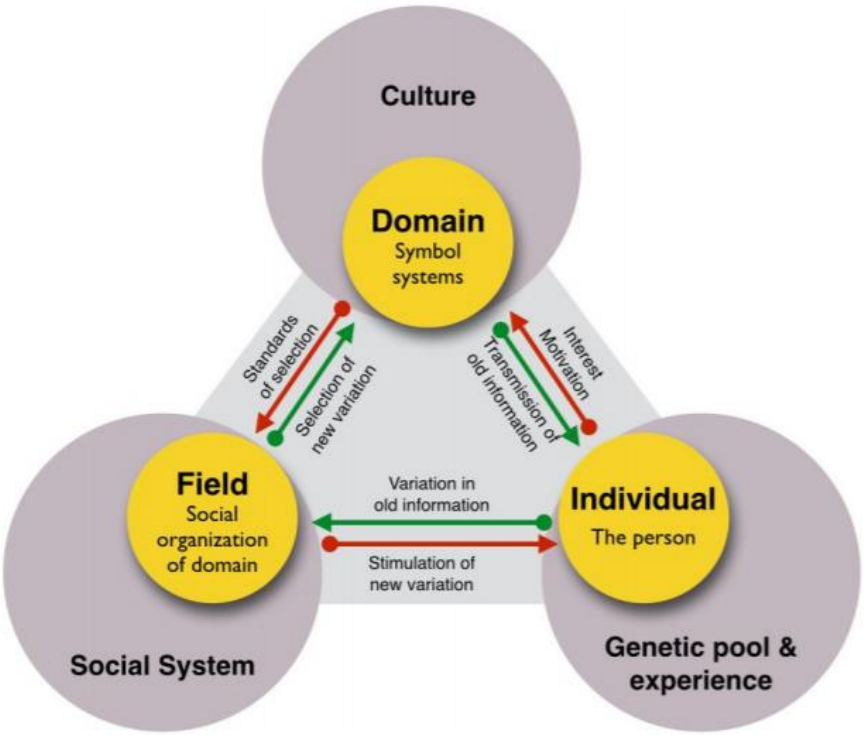
Appendix A

Conceptual Framework of 21st Century Student Outcomes and Support Systems



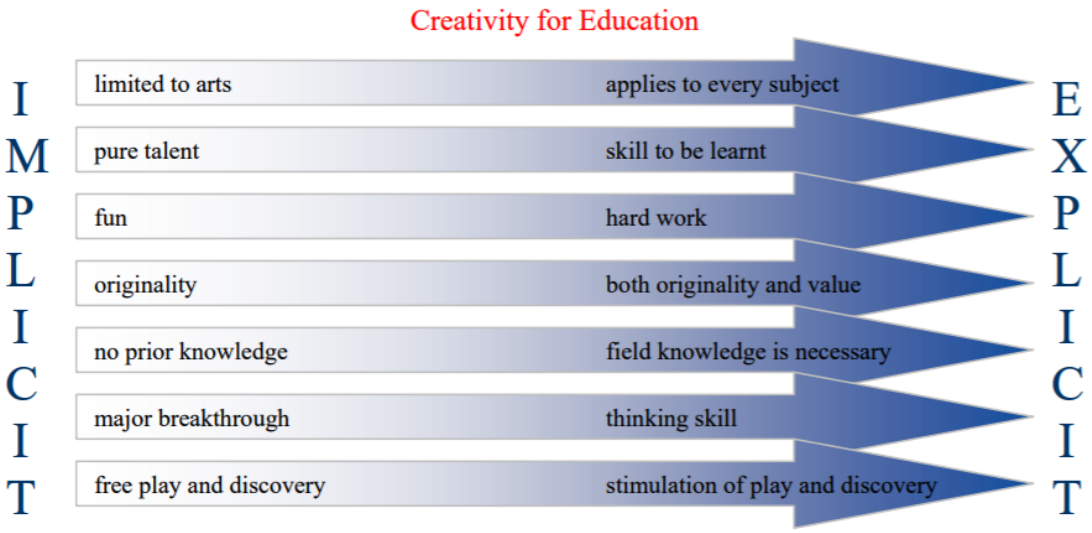
Appendix B

Csikszentmihalyi's Creativity Triangle



Appendix C

Creativity for Education



Appendix D

Pool of Questions by Trait

1. Reflection:
    a. I make time for reflection as a normal part of my practice.

        1 2 3 4 5

    b. Reflection has had an impact on my teaching.

        1 2 3 4 5

    c. I implement reflection time on a regular basis for my students.

        1 2 3 4 5

    d. I reflect on how I might improve.

        1 2 3 4 5

    e. I like to think about my day, what went well, and what I might change in the future.

        1 2 3 4 5

    f. I regularly provide time for students to reflect.

        1 2 3 4 5

    g. It is important for me to reflect on a daily basis.

        1 2 3 4 5

    h. Reflection for the purpose of improvement is important to me.

        1 2 3 4 5

2. Resilient:
    a. I model resiliency to my students.

        1 2 3 4 5

b. I develop resiliency in my students with varying levels of learning.

1 2 3 4 5

c. I have the ability to recover quickly from difficulties.

1 2 3 4 5

d. I can adapt to change.

1 2 3 4 5

e. I create opportunities for my students to develop resiliency with various activities.

1 2 3 4 5

3. Creators:

a. I create from my own learning and experiences.

1 2 3 4 5

b. I would say that I am creative.

1 2 3 4 5

c. I regularly come up with new ideas.

1 2 3 4 5

d. I provide opportunities for students to create and delve deeper *into* the curriculum.

1 2 3 4 5

e. I provide opportunities for students to create and delve deeper *outside* of the curriculum.

1 2 3 4 5

f. People say that I am creative.

1 2 3 4 5

g. I use my own learning and experiences to come up with new ideas.

1 2 3 4 5

4. Observant:

a. I look for opportunities to bring inspiration into my classroom.

1 2 3 4 5

b. I find my best ideas outside of the school setting.

1 2 3 4 5

c. I find my best ideas from a variety of resources.

1 2 3 4 5

d. I often think about bringing new ideas into the classroom.

1 2 3 4 5

e. My best ideas come from a variety of resources.

1 2 3 4 5

f. It is important to me to find ideas for my classroom outside of the school setting.

1 2 3 4 5

5. Networked:

a. I connect with teachers outside of my district that have influenced me.

1 2 3 4 5

b. I have made connections with others locally.

1 2 3 4 5

c. I have made connection with others globally.

1 2 3 4 5

d. I use Twitter, Facebook, Instagram, and other social media sites to connect with others.

1 2 3 4 5

e. I use Twitter, Facebook, Instagram, and other social media sites to connect with others globally.

1 2 3 4 5

f. My students have opportunities outside of the classroom to connect with others.

1 2 3 4 5

g. I provide opportunities for members of the community to be a part of my classroom.

1 2 3 4 5

h. I make a conscious effort to connect with others outside of my district.

1 2 3 4 5

6. Risk-Takers:

a. I tried something that didn't work with my students.

1 2 3 4 5

b. I often try new ideas in my classroom.

1 2 3 4 5

c. I tried something new with my students that didn't work.

1 2 3 4 5

d. I encourage my students to try new strategies in my classroom.

1 2 3 4 5

e. I provide opportunities for students to try new things in my classroom.

1 2 3 4 5

7. Problem-Finders/Solvers:

a. I encourage students to make an impact locally.

1 2 3 4 5

b. I encourage students to make an impact globally.

1 2 3 4 5

c. I tap into my students' passions and interest.

1 2 3 4 5

d. I provide opportunities for students to have an impact in their local community.

1 2 3 4 5

e. I provide opportunities for students to have an impact outside of their local community.

1 2 3 4 5

8. Empathy:

a. I often think about my classroom environment from my students' point of view.

1 2 3 4 5

b. I often think about learning opportunities I create for my students from their point of view.

1 2 3 4 5

c. I work to form positive relationships with my students.

1 2 3 4 5

d. I create learning opportunities for my students based on their hobbies and interests.

1 2 3 4 5

e. Forming positive relationships with students is important to me.

1 2 3 4 5

f. It is important for me to see my classroom environment from my students' point of view.

1 2 3 4 5

g. It is important for me to create learning opportunities for my students from their point of view.

1 2 3 4 5

Appendix E

Survey Instrument

D1. Indicate which grade level you teach.	K-2		3-5		
D2. Do you have one-to-one technology in your classroom?	Yes		No		
D3. What is your gender?	Male		Female		
D4. How many years of teaching experience do you have?	0-5 years	6-10 years	11-15 years	16+ years	
Directions: This survey asks questions about teacher innovative mindset and your beliefs and behaviors about classroom technology use. Click on the answer that best indicates your perception of each statement.					
1. Teaching students how to use technology is a part of my job.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
2. I can adapt to change.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
3. I provide opportunities for students to have an impact outside of their local community.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
4. I find my best ideas from a variety of resources.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
5. I use Twitter, Facebook, Instagram and other social media sites to connect with others locally and globally.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
6. I regularly plan learning activities/lessons in which students use technology.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

7. I use my own learning and experiences to come up with new ideas.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
8. I often think about learning opportunities I create for my students from their point of view.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
9. Reflection has had an impact on my teaching.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
10. I look for opportunities to bring inspiration into my classroom.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
11. I implement reflection time on a regular basis for my students.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
12. I have tried something in my classroom that didn't work.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
13. I have the ability to recover quickly from difficulties.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
14. I regularly come up with new ideas.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
15. I try to model effective technology use for my students.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
16. I create opportunities for my students to develop resiliency with various activities.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
17. I often think about bringing new ideas into the classroom.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
18. I provide opportunities for my students to have an	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

impact in their community.					
19. My students have opportunities outside of the classroom to connect with others.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
20. I often try new things in my classroom.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
21. I tap into my students' passions and interests.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
22. Using technology in the classroom is a priority for me.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
23. I provide opportunities for my students to try new things in my classroom.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
24. When planning instruction, I think about how technology could be used to enhance student learning.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
25. I create learning opportunities for my students based on their hobbies and interests.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
26. I make time for reflection as a normal part of my practice.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
27. I connect with educators outside of my district that have influenced me.	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Appendix F

Survey Question Breakdown

Innovative Mindset	• Teaching students how to use technology is a part of my job. • I use Twitter, Facebook, Instagram and other social media sites to connect with others locally and globally. • I regularly plan learning activities/lessons in which students use technology. • I try to model effective technology use for my students. • Using technology in the classroom is a priority for me. • I provide opportunities for my students to try new things in my classroom. • When planning instruction, I think about how technology could be used to enhance student learning. • I make time for reflection as a normal part of my practice.
Teacher Beliefs	• I can adapt to change. • I use my own learning and experiences to come up with new ideas. • I often think about learning opportunities I create for my students from their point of view. • Reflection has had an impact on my teaching. • I look for opportunities to bring inspiration into my classroom. • I have the ability to recover quickly from difficulties. • I regularly come up with new ideas. • I often think about bringing new ideas into the classroom.
Teacher Involvement	• I provide opportunities for students to have an impact outside of their local community. • I implement reflection time on a regular basis for my students. • I have tried something in my classroom that didn't work. • I create opportunities for my students to develop resiliency with various activities.

	• I provide opportunities for my students to have an impact in their community. • My students have opportunities outside of the classroom to connect with others. • I connect with educators outside of my district that have influenced me.
Teacher Engagement	• I find my best ideas from a variety of resources. • I often try new things in my classroom. • I tap into my students' passions and interests. • I create learning opportunities for my students based on their hobbies and interests.

Appendix G

Principal Email

Dear Esteemed Principal,

My name is Christen Glenn and I would like to invite two of your teachers to participate in a doctoral dissertation research study I am conducting as a student at Southwest Baptist University. The purpose of this quantitative study is to examine the relationship between innovative mindset and learning environments with and without one-to-one technology. Additionally, this quantitative study further examines teacher beliefs and behaviors around classroom technology use and mindset.

The survey takes approximately four minutes to complete. Teachers responses are completely anonymous and cannot be linked to them in any way. There is no known risk for your participation. Please use the following criteria to select two teachers in your building to forward the introductory letter and survey to:

- *One K-2 grade regular education teacher **AND** one 3-5 grade regular education teacher*
- *Teachers should exclusively teach grades kindergarten through fifth grade.*
- *Please only forward the survey to **TWO** classroom teachers in your building.*

Upon receiving completed survey responses from the two teachers you selected, you will receive my chapter five conclusions upon request. You can request chapter five conclusions by emailing cdglenn@spsmail.org.

Thank you for participating in this study; if you have questions or concerns about completing the survey or participating, please contact Dr. Duke Jones at rrb@subniv.edu. Please forward the introductory letter and survey by clicking the links below:

Introductory Letter
Survey Link

Your cooperation is very much appreciated.

Thank you,
Christen Glenn
Doctoral Candidate
Southwest Baptist University

Appendix H

Introductory Email to Teachers

Dear Teacher,

I would like to invite you to participate in a doctoral dissertation research study I am conducting as a student at Southwest Baptist University. The purpose of this quantitative study is to examine the relationship between innovative mindset and learning environments with and without one-to-one technology. Additionally, this quantitative study further examines teacher beliefs and behaviors around classroom technology use and mindset.

Your participation in this survey is voluntary, however, your assistance is needed to provide information which can help educational leaders determine whether specific learning environments foster characteristics of an innovative mindset in teachers. This research can provide valuable information about the beliefs and behaviors about classroom technology use and teacher mindset in order to provide educational leaders with future professional development and support opportunities for teachers.

The survey takes approximately four minutes to complete. Your responses are completely anonymous and cannot be linked to you in any way. Your principal, school administration, I, nor any other entity will know your responses. There is no known risk for your participation.

Thank you for participating in this study; if you have questions or concerns about completing the survey or participating, please contact Dr. Duke Jones at rrb@subniv.edu. Please begin the survey by clicking the link below:

Survey

Your cooperation is very much appreciated.

Thank you,
Christen Glenn
Doctoral Candidate
Southwest Baptist University