The Lived Experiences of Leading Edge Certified Elementary School Teachers Who Use Instructional Technology to Foster Critical Thinking, Collaboration, Creativity, and Communication in Their Classrooms: A Phenomenological Study

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The Lived Experiences of Leading Edge Certified Elementary School Teachers Who Use Instructional Technology to Foster Critical Thinking, Collaboration, Creativity, and Communication in Their Classrooms: A Phenomenological Study

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ABSTRACT

The Lived Experiences of Leading Edge Certified Elementary School Teachers Who Use Instructional Technology to Foster Critical Thinking, Collaboration, Creativity, and Communication in Their Classrooms: A Phenomenological Study

by Natalie Ruddell

Purpose: The purpose of this phenomenological study was to describe the perceptions of current and former Leading Edge Certified (LEC) elementary school teachers regarding instructional technology practices that facilitate students’ development of critical thinking, collaboration, communication, and creativity (4Cs) in one-to-one computer classrooms in Riverside County, California.

Methodology: This qualitative study utilized a phenomenological design. The primary source of data collection was a standardized, open-ended interview aligned to the research questions of 12 participants. This study employed inductive analysis to analyze the rich data. Using inductive analysis, the data were coded and themes were identified that aligned to the research questions.

Findings: Analysis of the data revealed that current and former Leading Edge Certified (LEC) elementary school teachers used several instructional technology practices to facilitate students’ development of critical thinking, collaboration, communication, and creativity (4Cs) in one-to-one computer classrooms. Participants identified four instructional technology practices to promote students’ critical thinking: gradual release of responsibility, problem solving, guided questioning, and self-reflection tools.

Participants described three instructional technology practices to facilitate collaboration among students: cooperative groups, peer-to-peer teaching, and shared presentation tools.

Three instructional technology practices were identified to support students’
communication skills: clear teacher expectations, self-selection of communication tools, and class discussion in a face-to-face or virtual environment. Additionally, the following were identified to encourage students’ creativity: self-expression and discovery/play with technology and Web 2.0 tools.

**Conclusions:** The researcher concluded that instructional technology practices LEC teachers use to facilitate critical thinking, collaboration, communication, and creativity in their one-to-one classroom can lead to student preparedness for college and career. Moreover, the researcher concluded the need to deepen teachers’ understanding of critical thinking, collaboration, communication, and creativity and their technology integration skills.

**Recommendations:** Seven areas of further research were recommended to increase the body of knowledge related to these variables.
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CHAPTER I: INTRODUCTION

The United States (U.S.) public education system is in a tumultuous transition. U.S. students continue to be surpassed by students in developing countries in problem-solving skills, math, science, and reading literacies, resulting in the United States’ declining position as a global superpower (The Council on Foreign Relations, 2012; Friedman & Mandelbaum, 2011; Organisation for Economic Co-operation and Development [OECD], 2009, 2012a; Wagner, 2014). Therefore, the most recent revision to Lyndon B. Johnson’s 1965 Elementary and Secondary Education Act (ESEA), the Every Student Succeeds Act ([ESSA], 2015) requires more rigorous standards to prepare students for college and career, improve graduation rates, and promote innovation.

Simultaneously, with the advent of the Internet in the late 1980s and continuous innovation in technology, the world became smaller as information became accessible 24 hours a day, 7 days a week (Friedman, 2007). The U.S. government, understanding the ramifications of the Internet and technology on education, began to establish their importance in a 1983 report recommending computer science as a high school graduation requirement (Alliance for Excellent Education [AEE], 1983). In addition, the U.S. government began to invest heavily in the infrastructure and Internet access through government policy (AEE, 1983; Office of Educational Technology [OET], 2013, 2016; Ringstaff & Kelley, 2002). The U.S. government recognizes, more than ever, the urgency to support schools in preparing students for the 21st century.

Similarly, California understands the importance to prepare its students for college and career in the 21st century in order to continue to prosper economically and socially (Education Trust-West, 2015; Richmond, 2009). Although California adopted
the rigorous, internationally benchmarked Common Core State Standards and embraced federal policies to improve access to the Internet and technology, high school graduation rates have only increased slightly, and many areas of the state still continue to struggle with equity in Internet access and technology (California Department of Education [CDE], 2010, 2014b, 2014c; Darling-Hammond & Rattray, 2011).

U.S. high school students continue to lag behind their international counterparts in problem solving, math, science, and reading literacies, resulting in a diminishing perception of the United States as a competitive global superpower (Friedman & Mandelbaum, 2011; Wagner, 2014). In order to regain its position of perceived power in the world arena, the United States will need to reflect on how to integrate technology effectively with the teaching and learning of 21st-century skills within the K-12 educational system (Lotto & Barrington, 2006).

**Background**

Five main areas are reviewed in the background section. First, the transition in public education with emphasis on the economic, political, and social change drivers leading to the shift in the teaching and learning of 21st-century skills are examined. Second, the role of technology in education is studied, with a focus on the conceptual framework of 21st-century skills described by the Partnership for 21st Century Learning (2015). Third, the history of technology in education is considered. Fourth, the changing demands in education, especially the teaching and learning within the classroom, are reviewed. Finally, the teacher’s role in the integration of 21st-century skills is explored.
Public Education in Transition

Since the publication of the report *Nation at Risk*, the United States has enacted various policies and programs to reclaim its position as a global superpower (AEE, 1983). The report concluded that the United States’ educational system lacked rigorous courses of study, had low expectations to master the content, provided less time in school, and did not recruit the best and brightest into the teaching profession, in comparison to other industrialized countries (AEE, 1983). Furthermore, various external change drivers have increased the scrutiny of public education.

**Economic change drivers.** The Program for International Student Assessment (PISA) measures the degree of knowledge and skills that 15-year-old students in the 34 countries participating in the OECD have acquired to be productive global citizens. Recent results indicate the United States, in comparison to other developed countries, continues to rank in the middle of the pack (OECD, 2012a, 2012b). In addition, a consortium of four businesses and nonprofit organizations surveyed U.S. businesses to determine high school students’ preparedness for the workforce. Respondents indicated over 50% of high school students lacked communication, critical thinking, and problem-solving skills needed to compete in a global market (AEE, 2011). Similarly, Tony Wagner (2014), after interviewing numerous U.S. business leaders, stated that today’s U.S. students lack the seven survival skills needed to increase the economic competitiveness of the United States and to be productive global citizens.

**Political change drivers.** The political ramifications of the *Nation at Risk* report and the outcry from economic leaders for a better prepared workforce resulted in several
federal initiatives (AEE, 2015; Busch et al., 2007; Kline & Williams, 2007; Office of Technology Assessment [OTA], 1982; Wagner, 2014).

In 2001, the standards movement and the No Child Left Behind Act ([NCLB], 2002) was passed to increase school accountability and close the achievement gap. Since the United States continued to struggle academically compared to other developed countries, President Obama established the Race to the Top initiative in 2010 to provide the states with incentives to adopt the internationally benchmarked Common Core State Standards ([CCSS], 2010b; USDE, 2009). The CCSS aims to shift the teaching and learning to focus on critical-thinking skills in order to support students’ college and career readiness and increase students’ competitiveness in the global arena (CCSS, 2010b; Darling-Hammond & Rattray, 2011; The Council on Foreign Relations, 2012).

Simultaneously, President Obama established the National Education Technology Plan (NETP) to support the integration of technology into the educational setting to transform teaching and learning where students’ learning is personalized and the world is their classroom (OET, 2010).

**Cultural change drivers.** With the emergence of the Internet in the late 1980s, the USDE OTA predicted in 1982 that the Internet would cause an “information revolution” and result in technology’s becoming an educational focus as students would need to adapt to an ever-changing workforce where information and digital literacy are vital to compete.

Then the increased Internet accessibility to U.S. citizens throughout the 1990s, due to smaller, more affordable devices, resulted in the need for the federal, state, and local governments to address technology integration into the educational system (Fouts,
2000). In addition, Internet access made the world smaller and empowered individuals worldwide to connect and exchange ideas and commodities (Friedman, 2007). Also, the continuous flow of information on the Internet is available 24 hours a day, 7 days a week, providing individuals the opportunity to learn new information at any moment in time (November, 2008, 2012). Furthermore, easy access to information on the Internet has shifted society from an Industrial Age to a Knowledge Age (Gilbert, 2007). Researchers state that in the Knowledge Age, “intellectual property” and creative service-based jobs are more vital to a growth economy (Gilbert, 2007, p. 4).

Since the birth of the Internet and increased access to information, a shift has occurred in society from an industrial to an information era. This cultural shift has also had an impact on the teaching and learning in schools. Since the 1980s, students have been considered Digital Natives who are digitally literate but have a difficult time engaging in the classroom of their Digital Immigrant teachers (Prensky, 2001a, 2001b). Digital Immigrant teachers continue to believe they are the content experts and need to impart their knowledge to their Digital Native students (Prensky, 2001a, 2001b; November, 2012). Other leaders in the field agree that the K-12 public schools of the Industrial Age do not align with the learning needs of the 21st century learner (Crockett, Jukes, & Churches, 2011; Kelly, McCain, & Jukes, 2009; Tapscott, 2009).

**Technology in Education**

With the dawn of the 21st century, business leaders and colleges throughout the United States continue to indicate students are not prepared for the workforce or college (Hart Research Associates, 2005; Kline & Williams, 2007; Wagner, 2014). The Partnership for 21st Century Learning, founded in 2002, developed a framework to
support students’ 21st-century skills readiness. The P21 framework includes the
development of core content areas, along with 21st-century interdisciplinary themes, life
and career skills, information/technology skills, and learning and innovation skills,
known as the 4Cs: critical thinking, creativity, collaboration, and communication (P21,
2015). Similarly, other researchers also began to identify the 4Cs as skills U.S. students
need to be future ready and competitive as global citizens (Lotto & Barrington, 2006;

In addition, researchers continue to state the importance of the use of technology
in education. In 2007, the State Educational Technology Directors Association
(SETDA), the International Society for Technology in Education (ISTE), and the
Partnership for 21st Century Learning (P21), commissioned a report to explore
technology’s role in preparing students for the 21st century. The researchers discovered
education is the only industry that does not use technology to its full potential. However,
when technology is used in the educational setting, it is used mostly to develop computer
skills and not the critical thinking, creativity, communication, and collaboration skills
(Busch et al., 2007).

**History of Technology in Education**

Although the U.S. president, the USDE, and business leaders understand it is
imperative to integrate technology in education to support students’ acquiring 21st-
century skills, researchers assert most of the U.S. government’s investment has targeted
access and infrastructure rather than transforming the established culture of the traditional
industrial model school system (Culp, Honey, & Mandinach, 2003; Robinson, 2011;
Wagner, 2014.)
Past educational technology integration attempts to transform education. In the last 3 decades, the educational system has seen an increase in the amount of computer technology and infrastructure. Researchers in the early 1980s indicated the increased dependency on technology would result in an “information revolution” leading to a profound shift in the teaching and learning in schools. The U.S. government’s response included placing a focus on technology integration when NCLB was enacted to close the academic achievement gap (NCLB, 2002). Other researchers determined, after reviewing U.S. educational technology policy, that the U.S. government understood the need to increase technology literacy to produce critical thinking citizens prepared for an ever-changing workforce (Culp et al., 2003). However, researchers continue to find the focus of computer technology use in education is on either access and infrastructure or low-level tasks, such as word processing and communication (Gray, Lewis, & Thomas, 2010; Ringstaff & Kelley, 2002).

Current educational technology trends. Researchers have established that the U.S. government tends to focus more on access than on transformation of teaching and learning. President Obama’s introduction of the ConnectED initiative to ensure 99% of America students have access to broadband by 2018 is a further indication of the continued focus on access (ConnectED, 2013; Duffey & Fox, 2012). However, other researchers continue to state the need to leverage technology to support the transition to the 21st century and transform classroom teaching and learning (Busch et al., 2007; OET, 2010; P21, 2003). For instance, classrooms need to be student centered, where the students own their learning and the teacher is a guide to support the students’ learning journey (November, 2012; OET, 2010).
Changing Demands in K-12 Public Education

The world is shrinking due to global connectivity with continued innovation and cost-effective technology; U.S. students have instant access to information, resulting in students learning differently than the majority of their classroom teachers (Friedman, 2007; Kivunja, 2014a, 2014b; Prensky, 2001a, 2001b). In addition, since employers need creative critical thinkers, communicators, and collaborators, the federal, state, and local governments continue to focus their legal and financial efforts to improve K-12 students’ preparedness for college and career (CDE, 2010; The Council on Foreign Relations, 2012; Lotto & Barrington, 2006; P21, 2003). Furthermore, the CDE incorporated the P21 framework, with a special emphasis on technology integration into the teaching and learning of both English language arts and math (CDE, 2014b, 2015). However, classroom teachers struggle to adapt their teaching to incorporate the 21st-century skills and the integration of technology (Prensky, 2007).

Teachers

In order to shift the teaching and learning of Digital Immigrant teachers to support students with acquiring 21st-century skills, teachers need to be taught how to integrate their pedagogical and content knowledge with technology (Mishra & Koehler, 2006; Prensky, 2001a, 2001b). In the past, if technology was evident in the classroom, it was used as an administrative tool rather than to support the delivery of content or 21st-century skills (Gray et al., 2009). The technological pedagogical content knowledge (TPACK) framework provides teachers the opportunity to reflect on technology selection, based on the content being taught and how to integrate the technology to support the learning of content and the 21st-century skills (Mishra & Koehler, 2006).
Although the TPACK framework supports teachers with the integration of technology, their content, and pedagogy, it neglects to support teachers in the further integration of the 4Cs: critical thinking, creativity, collaboration, and communication. According to experts, to further support teachers in the integration of technology to facilitate the learning of the 4Cs in their students, teachers also need training in the ever-changing Web 2.0 tools along with a framework to guide their teaching practices (ISTE, 2008; Mishra & Koehler, 2006; Ringstaff & Kelley, 2002). To support teachers with the integration of the 4Cs along with technology into their content and pedagogy, a new certification called the Leading Edge Certificate (LEC) was developed (Leading Edge Certification, n.d.-b). The LEC for digital educators is a certification granted to educators after successful completion of a digital portfolio with technology-enhanced projects demonstrating learning activities that encourage students to think critically, communicate, collaborate, and create. The Digital Educator LEC curriculum is based on NETP, CCSS, and the ISTE Standards (formerly known as the NETS) for Teachers (ISTE-T; Baker, 2012; Quillen, 2012).

A Gap in Research

Several studies and reports indicate technology is an integral part to moving the K-12 public education system toward the teaching and learning of 21st-century skills (Busch et al., 2007; OET, 2010, 2016; P21, 2003). In addition, researchers suggest the importance of a common framework to guide this transition to 21st-century learning (ISTE, 2008; P21, 2015). Moreover, several studies reveal business leaders continue to report that students are ill prepared to apply skills such as critical thinking, creativity, collaboration, and communication to new situations (Friedman & Mandelbaum, 2011;
Wagner, 2014). However, researchers indicate technology continues to be used either as an administrative tool or for low-level tasks such as word processing (Gray et al., 2010).

Recent studies indicate the need to examine how teachers facilitate the learning of 21st-century skills using technology in the classroom (November, 2008, 2012; P21, 2003; Wagner, 2014). One study noted the need for a qualitative study to describe teachers’ technology integration into their classroom practice to complement the quantitative ratings yielded from teachers’ self-assessment of technology integration using the TPACK framework (Fontanilla, 2015). Understanding the lived experiences of current and former Leading Edge Certified elementary school teachers regarding what instructional practices facilitate students’ development of critical thinking, collaboration, communication, and creativity in one-to-one computer classrooms may contribute to the body of knowledge related to public schools ensuring K-12 students are prepared for college and career and to be competitive global citizens.

**Statement of the Research Problem**

Leading U.S. business and government leaders report K-12 public school students are not prepared to be productive global citizens in a “dynamic digital world” (Busch, et al., 2007, p. 2). In order to be successful in the ever-changing digital world, students need an education integrating technology into all aspects of their learning and fostering critical thinking, creativity, communication, and collaboration (November, 2012; OET, 2010; Wagner, 2014).

Although all levels of the U.S. government—federal, state, and local—understand the importance of teaching the 21st-century skills and integrating technology into the classroom, there is little research on elementary school teachers’ perceptions of the
instructional practices used to foster critical thinking, creativity, communication, and collaboration in a one-to-one computer classroom (ConnectED, 2013; Fontanilla, 2015; Mishra & Koehler, 2006; USDE, 2009). In addition, researchers indicate most government funding continues to focus more on ensuring students’ access to the Internet and infrastructure, such as data and learning management systems, rather than the day-to-day teaching of the critical thinking, creativity, communication, and collaboration through technology integration (ConnectED, 2013; Duffey & Fox, 2012; USDE, 2009). Furthermore, others report the use of technology within the classroom with students included low-level tasks, such as word processing and spreadsheets, rather than higher order thinking skills (Gray et al., 2010; Ringstaff & Kelley, 2002).

Although California embraced the rigor of CCSS and revised the English and math frameworks to include the integration of 21st-century skills and technology based on the P21 framework, California also struggles to prepare its students for the knowledge-based world of the 21st century (CDE, 2010, 2014b, 2015; P21, 2003, 2015). According to the 2011 National Assessment of Educational Progress (NAEP), the largest nationally continuing assessment of what America’s students know and can do in reading, math, and science, California ranked 48th out of 50 states in all subjects areas (Darling-Hammond & Rattray, 2011). In addition, California graduation rates have plateaued in the last 5 years, at approximately 85% (CDE, 2014c). A recent California blueprint for educational technology acknowledged that the classroom needs to be a “learning environment that takes students beyond the walls of the classroom and into a world of endless opportunities” (Torlakson, 2014, p. 4). However, in the same report, the focus tended to be toward adequate access to technology and high-speed Internet
connectivity, rather than on the fostering of the 21st-century skills in the classroom using technology (Torlakson, 2014).

Despite numerous studies that examined the relationship or experiences of teachers integrating technology based on professional development, differentiation, or the TPACK framework, there are few studies that explore how elementary teachers foster the 21st-century skills while integrating technology in a one-to-one classroom (Atkinson-Collier, 2015; Fontanilla, 2015; Langham, 2014).

**Purpose Statement**

The purpose of this phenomenological study was to describe the perceptions of current and former Leading Edge Certified (LEC) elementary school teachers regarding instructional technology practices that facilitate students’ development of critical thinking, collaboration, communication, and creativity (4Cs) in one-to-one computer classrooms in Riverside County, California.

**Research Questions**

This study was guided by one central question. The central question was divided into four subquestions.

**Central Question**

What are the lived experiences of current and former Leading Edge Certified (LEC) elementary school teachers in facilitating students’ learning of critical thinking, collaboration, communication, and creativity skills through technological instructional practices in one-to-one classrooms?
Subquestions

1. What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate critical thinking in their one-to-one classroom?

2. What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate collaboration in their one-to-one classroom?

3. What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate communication in their one-to-one classroom?

4. What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate creativity in their one-to-one classroom?

Significance of the Problem

Over 30 years ago, the world experienced a disruption throughout its economic, political, and social fiber. The Internet brought the “information revolution” (OTA, 1982, p. 3).

The USDE understood the importance to prepare K-12 students for an ever-changing environment and invested heavily in educational technology (AEE, 1983; Culp et al., 2003; NCLB, 2002). However, the public education system did not adapt as quickly to this profound change. In comparison to students among the other 34 OECD countries, U.S. high school students’ rankings in math, reading, and science were 26th, 17th, and 21st (OECD, 2012a). In addition, U.S. business leaders indicate that almost 50% of U.S high school students are not prepared for college and career in the 21st century (AEE, 2015; The Council on Foreign Relations, 2012; Kline & Williams, 2007;
Although the skills employers seek are the same from a century ago—critical thinking, creativity, collaboration, and communication—the difference is that students today need to be able to apply and adapt these skills in a continuously evolving digital age (The Council on Foreign Relations, 2012; Crockett et al., 2011). A similar trend is present in California. Students in the fourth and eighth grades have shown little growth on the math and reading NAEP and have continued to perform below the national average (National Center for Educational Statistics, 2015). In addition, state assessments indicate 11th graders are not prepared for either college English or math (CDE, 2014a). Moreover, the CDE understands the integration of technology and the 21st-century skills into classroom teaching is key to preparing students to adapt and be able to learn and unlearn because the jobs of the future are yet to exist (Crockett et al., 2011; Darling-Hammond, 2010; Torlakson, 2014).

However, like the USDE, the CDE’s focus continues to be Internet access and infrastructure, as Tom Torlakson (2014), the State Superintendent of Public Instruction, described a priority for California is “no child is left off-line” (p. 8).

Recent research on the integration of technology in the classroom has centered on teacher self-efficacy, pedagogical beliefs, the integration of TPACK in teaching content, differentiation, and professional development (Atkinson-Collier, 2015; Ertmer & Ottenbreit-Leftwich, 2010; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012; Fontanilla, 2015; Langham, 2014; Mishra & Koehler, 2006). Several researchers indicated the need for further research on additional factors contributing to teachers’ decisions to integrate technology in the classroom and successful implementation of instructional technology (Fontanilla, 2015; Langham, 2014). This study will add to the
existing literature by delving deeper into the instructional practices elementary school Leading Edge Certified (LEC) teachers use to foster critical thinking, creativity, collaboration, and communication in a one-to-one classroom.

The description and exploration of the lived experiences of how LEC elementary school teachers foster critical thinking, creativity, collaboration, and communication (4Cs) in their classroom may lead to a better understanding of improving high school students’ readiness for college and career in the 21st century. Moreover, the findings may contribute to future professional development by county offices of education and school districts to support effective instructional strategies to foster the 4Cs in one-on-one classrooms.

Definitions

The following definitions were used in this study:

**Computational thinker.** Students use technological methods and complex systems thinking to develop and employ strategies to understand and solve problems (ISTE, 2016a).

**Content knowledge (CK).** A teacher’s understanding and knowledge of the content or subject matter to be taught (Howell, 2012; Koehler & Mishra, 2009).

**Creative communicator.** Students use a variety of digital platforms to express themselves and their ideas creatively for a variety of audiences and purposes (ISTE, 2016a).

**Digital citizen.** Students understand their rights, responsibilities, and opportunities of living in an interconnected, blended environment and behave in a safe, legal, and ethical manner in both the physical and digital worlds (ISTE, 2016a).
Empowered learner. Students leverage technology to take an active role in their learning. Students establish, communicate, apply, and self-monitor their competency toward meeting their individual learning goals (ISTE, 2016a).

Global collaborator. Students use digital tools to work in collaborative teams both locally and globally to expand their perspective and enrich their learning experience (ISTE, 2016a).

Individual electronic device. A laptop, tablet, iPad, or Chromebook.

Innovative designer. Students utilize various technologies within the design process to identify and solve problems through the creation of innovative solutions (ISTE, 2016a).

Instructional strategies. All approaches that a teacher may take to engage students in the learning process actively (Meador, 2016)

Instructional technology. Educators appropriately selecting technology resources to enhance the technology processes of teaching practices and learning experiences (Earle, 2002).

International Society for Technology in Education (ISTE). Standards for learning, teaching, and leading in the digital age to transform education (ISTE, n.d.).

Knowledge constructor. Students critically examine resources using digital tools to construct meaning and produce creative projects to make learning relevant to themselves and others (ISTE, 2016a).

Leading Edge Certification (LEC) for digital educators. A certification granted to educators after successful completion of a digital portfolio with technology-enhanced projects demonstrating learning activities that encourage students to think
critically, communicate, collaborate, and create. The Digital Educator LEC curriculum is based on National Education Technology Plan, Common Core State Standards, and the ISTE Standards (formerly known as the NETS) for Teachers (ISTE-T).

**One-to-one classroom.** A classroom in which every student has an electronic device.

**Pedagogical content knowledge (PCK).** A teacher’s understanding and ability to choose the appropriate pedagogy or approach for the teaching and learning of a specific content area (Howell, 2012; Koehler & Mishra, 2009; Shulman, 1986).

**Pedagogical knowledge (PK).** A teacher’s deep understanding of the theories, processes, and/or practices of teaching and learning (Howell, 2012; Koehler & Mishra, 2009).

**Technological content knowledge (TCK).** A teacher’s understanding of which technology is best suited to address specific content learning (Koehler & Mishra, 2009).

**Technological pedagogical content knowledge (TPACK).** A teacher’s understanding of the “complexity of the relationship between the students, teachers, content, practices and technologies” and to use this multifaceted knowledge to strategically and effectively integrate technology into their teaching to improve student learning (Howell, 2012, p. 32).

**Technology.** Computer-based tools (Ringstaff & Kelley, 2002).

**Technology knowledge (TK).** A teacher’s ever-evolving understanding and “open-ended interaction” with technology to enhance the learning environment (Howell, 2012; Koehler & Mishra, 2009).
Technological pedagogical knowledge (TPK). A teacher’s understanding of “how teaching and learning can be changed when particular technologies are used in particular ways” (Koehler & Mishra, 2009, p. 65).

Technology processes/practices. Educators’ pedagogy, the study of teaching and learning processes, and instructional practices (Howell, 2012).

Technology resources. Include Internet access, infrastructure, hardware, and software (National Center for Education Statistics [NCES], 2002).

21st-century skills. Essential skills students need to be productive and competitive citizens in a global society. For the purpose of this study, these skills are critical thinking, creativity, communicating effectively, and working collaboratively and often referred as the 4Cs (P21, 2015).

Web 2.0 tool(s). A second generation in the development of the World Wide Web, conceived as a combination of concepts, trends, and technologies that focus on user collaboration, sharing of user-generated content, and social networking.

Delimitations

This study was delimited to elementary school teachers who had a Digital Educator LEC certificate and were employed at a public elementary school in Riverside County, California.

Organization of the Study

The remainder of this study is organized into four additional chapters, the list of references, and the appendices. Chapter II provides a review of the literature regarding the change drivers affecting K-12 education in the 21st century, the 21st-century skills framework, the history of technology in education, and the role of the teacher. Chapter
III describes the methodology of the study, including the research design, sample, data collection protocols, data analysis procedures, and limitations of the study. Chapter IV presents the findings of the study in a report of collected data and the results of data analysis. Chapter V presents a summary of the study and provides major findings and conclusions, implications for actions, and recommendations for future research.
CHAPTER II: REVIEW OF THE LITERATURE

Chapter II presents a review of the relevant literature to establish a framework for the study (see Appendix A). The review of literature is organized into four key sections. First, the change drivers related to the transitions seen in public education is reviewed. Second, the evolution and purpose of education technology is examined. In the third section, the theoretical and conceptual frameworks associated with fostering 21st-century skills through technology integration are discussed. Fourth, the role of the teacher in the classroom is reviewed, with particular attention to fostering critical thinking, collaboration, creativity, and communication in a one-to-one classroom environment. The chapter concludes with a summation of the literature and identifies the gaps in the research to support the purpose of this study.

Change Drivers Affecting Public Education in the 21st Century

The intent of education is to impart society’s history and culture to future generations not only to set the nation’s youth up to be successful and productive citizens but also to perpetuate a culture’s existence. In the past, the United States modeled its educational system on the industrial model where, according to Cubberley (1916), “schools (were), in a sense, factories in which the raw products (children) are to be shaped and fashioned into products to meet the various demands of life” (p. 338). The industrial model was beneficial to the educational system over the last century because society and the job market needed employees to fill specific technical skills, especially in the blue-collar fields such as manufacturing and construction. However, with the advent of the Internet in the late 1980s to early 1990s, information became more accessible, people began to connect in the global arena, and the demands of the workplace began to...
shift more toward white-collar careers as the United States moved away from the Industrial Age to the Knowledge Age (Robinson, 2015; Schlechty, 1990; Wagner, 2012). Within the last 30 years, the Internet and technology have become more advanced, innovative, and most importantly, affordable for the average person, resulting in globalization and a society insistence on a change in the way the United States educates its youth. In an information-based society, the workplace needs a workforce that can think and learn for themselves to adapt to an ever-changing environment (November, 2012; Schlechty, 1990).

**Economic Change Drivers**

Education plays a vital role in preparing students to contribute to the global economy upon graduation from high school and college. Businesses require a workforce adept in critical thinking, collaboration, creativity, and communication because the world is changing at an ever-increasing rate and the jobs of today will not be the jobs of tomorrow; therefore, the workforce must be able to adapt and possibly create new jobs instantaneously in the future (Trilling & Fadel, 2009).

The United States has been a member of the Organisation for Economic Co-operation and Development ([OECD], n.d.), a global forum for governments to work collaboratively to seek solutions to common economic, social, and environmental issues, since 1961. The OECD developed the Program for International Student Assessment (PISA) in 1997 in response to member countries’ request for consistent and reliable data (OECD, n.d.). The PISA, an internationally benchmark assessment, measures 15-year-old students’ performance in reading, math, and science as well as the performance of OECD members’ education systems (OECD, n.d.). The PISA has been administered
every 3 years since its first administration in 2000, and the United States has not made significant growth in any area within this timeframe (OECD, 2012a). In mathematics, the United States ranked 27th out of 34 member countries, 17th in reading, and 20th in science (OECD, 2012a). In addition, beginning in 2012, OECD leaders began to assess students’ problem-solving skills to measure the extent subject-content skills in reading, mathematics, and science transferred to skills that adults needed to be “reflective, communicative problem solvers” throughout their life (Wagner, 2014, p. 74). The problem-solving skills included were analyzing a real-life situation and making a decision while considering multiple variables, understanding the underlying relationships of the given situation, solving the problem systematically, reflecting on one’s thinking process for accuracy, and communicating the results (Wagner, 2014). The United States ranked 13th out of 28 member countries, and more than 18.2% of U.S. 15-year-old students did not reach the baseline level proficiency in problem-solving skills (OECD, 2012b; Wagner, 2014). The PISA trend data results had U.S. employers questioning the preparedness of its future workforce with the skills most relevant to 21st century jobs: problem solving, critical thinking, and collaboration (Gallup, Inc., 2014).

U.S. employers have continually expressed their concern over the incoming workforce’s readiness for career and college. In a study conducted for Achieve, a nonprofit educational reform organization, 41% of employers were dissatisfied with high school graduates’ reading ability, 42% believed they could not think analytically, 39% believed high school graduates have difficulty applying their learning to real-world problems, and 34% believed students could not communicate effectively (Hart Research Associates, 2005). In addition, the business community identified the necessary applied
skills the future workforce would need to perform and be successful. These applied skills included communication, collaboration, critical thinking/problem solving, and work ethic as the most important skills required for success in the workplace (Kline & Williams, 2007; Lotto & Barrington, 2006). Moreover, 93% of employers of college graduates expressed a candidate’s ability to be innovative/creative, think critically/problem solve, and collaborate were more important than the candidate’s major in college (Hart Research Associates, 2013).

Within the last century, the United States has moved from an agrarian and manufacturing economic system. Technical skills were vital to success in both of these economic systems. However, as the global economy has moved toward a more service-based system, skills such as critical thinking/problem solving, collaboration, communication, and innovation/creativity skills are critical for U.S. youth to become self-learners and adapt to an ever-evolving global economy and job market (Friedman & Mandelbaum, 2011; Wagner, 2012). Researchers and the business community recognized this gap in the U.S youth skill set and appealed to the U.S government for policy change to meet the future economic demands of a global marketplace (Alliance for Excellent Education [AEE], 2015; Friedman, 2007; Friedman & Mandelbaum, 2011; Wagner, 2012).

**Political Change Drivers**

Since the Space Race began with the Russian launch of Sputnik I in 1957, the U.S. government has implemented various federal mandates to reform public education to maintain its place as a world power (Elementary and Secondary Education Act
One of the most influential federal legislations on public education was President Lyndon B. Johnson’s ESEA of 1965. The intent of ESEA was to ensure all students had equal access to a quality education, including high standards and accountability, so the future workforce would remain competitive against other world powers, especially Russia.

Then in 1983, *A Nation at Risk* report stated that the educational system had settled for mediocrity and was not meeting the nation’s need for a competitive workforce (U.S. Department of Education [USDE], 1983). The report recommended standards that were more rigorous and established the number of years that students needed to study particular content areas. In addition, due to the introduction of the Internet and increased use of computers, the recommendation to study computer science for one half year indicated the rising importance of students understanding the theory and design of technology-based systems.

NCLB of 2001, a reauthorization of ESEA, expanded the federal government’s role in holding states accountable for closing the student achievement gap and advancing the United States’ competitiveness (Klein, 2015; NCLB, 2002). NCLB mandated states to individually define proficiency through the development of high academic standards and then establish measurable goals to ensure all students were proficient in reading and mathematics by 2014 and to ensure teachers were highly qualified to teach in their content areas (NCLB, 2002). Furthermore, NCLB established technology-integration goals to increase student outcomes using technology. These goals included assistance to
states in the building of infrastructure, broadband high-speed Internet connections, and accessibility to technology. Moreover, NCLB sought to ensure students were technologically literate by the end of eighth grade (Learning Point Associates, 2007; NCLB, 2002; USDE, n.d.).

Federal legislation continued to reflect the urgency to improve U.S. competitiveness in 2009 when President Obama challenged states with the Race to the Top grant program. President Obama stated, “America will not succeed in the 21st century unless we do a far better job of educating our sons and daughters . . . and a Race to the Top grant . . . will not only help students outcompete workers around the world, but let them fulfill their God-given potential” (The White House, 2009, p. 1). The Race to the Top grant required states to adopt national standards, Common Core, that were internationally benchmarked to prepare students for college and career and compete in a global market (USDE, 2009). Since the Race to the Top Grant was a competitive grant, not all states adopted the Common Core standards. However, in 2015, ESSA, a reauthorization of ESEA that required all the states to use the national standards to prepare students to succeed in college and career, was enacted. The national Common Core standards called for students to think critically, communicate effectively, collaborate, and be creative (Common Core State Standards Initiative [CCSS], 2010a, 2010b, 2010c). In addition, the new standards incorporated the use of technology within the “College and Career Anchor Standards” for reading, writing, speaking, and listening to enhance students’ critical thinking, communication, creativity, and collaboration skills (CCSS, 2010a). Moreover, the assessments of the CCCS are computer adaptive,
federally mandated tests administered online to support an accurate measurement of skills (Herold, 2016; Smarter Balanced Assessment Consortium, n.d.).

The literature indicates the federal government implemented various education policies over the last 50 years to support the United States’ advancement in an ever-increasing global economy. Many of these policies have also included the use of technology in the classroom by incorporating its use within content standards and mandating students be assessed using computers, indicating technology’s rising importance in society (CCSS, 2010a, 2010b, 2010c; ESSA, 2015; NCLB, 2002; USDE, 1983, 2009).

Cultural Change Drivers

In the 1980s, the Internet and World Wide Web were introduced to society. The Internet, along with continual innovation in making electronic devices more portable and affordable has enabled people to communicate, conduct business, collaborate to share innovative ideas in real-time with a few clicks of a button from anywhere in the world, resulting in increased interdependence among countries and globalization (Friedman, 2007; Office of Technology Assessment [OTA], 1982; Wagner, 2012). The merging of innovative technology and globalization has caused revolutionary change, shifting society away from an industrial-based to an information- or knowledge-based system (Friedman, 2007; Gilbert, 2007; Robinson, 2015; Summers, 2015; Trilling & Fadel, 2009; Wagner, 2014). This knowledge-based system has placed new demands, and individuals need to adapt to participate fully in modern society. Since information changes rapidly, individuals are required to have the skills to adapt and be technologically and
informationally literate in order to access information to retrain themselves to thrive in society (OTA, 1982).

As society moved toward an information- or knowledge-based environment, it has had a tremendous impact on the U.S. educational system (see Table 1). For instance, students, within the Information Age education system, are “digital natives,” generations immersed in digital technology since birth who expect constant and continual access to information, technology, and each other on their own terms (Prensky, 2001a, 2001b; Tapscott, 2009; Trilling & Fadel, 2009). On the other hand, the majority of educators are “digital immigrants,” generations who grew up within the Industrial Age model and have tried to adapt to the new Information Age environment; however, they have struggled to teach and keep pace with their digital native students (Prensky, 2001a, 2001b). In order to maintain relevance in the Information Age society, schools and teachers need to shift the way they teach and learn (November, 2012; Prensky, 2001a, 2001b; Tapscott, 2009; Trilling & Fadel, 2009; Wagner, 2014).

Today’s students are digital natives and require an engaged, active learning environment (November, 2012; Prensky, 2001a, 2001b; Trilling & Fadel, 2009; Wagner, 2014). They enjoy working through real-world problems collaboratively. In addition, digital natives use critical thinking to analyze and establish the validity of large amounts of information. They also develop creative and innovative solutions. Moreover, they communicate their findings to their teachers, peers, and the world in a variety of multidigital venues (November, 2012; Prensky, 2001a, 2001b; Trilling & Fadel, 2009; Wagner, 2014). Although digital natives need the 21st-century skills of collaboration, critical thinking, creativity, and communication skills to be successful and productive
global citizens, most schools have not taught these skills (Prensky, 2001a, 2001b; Trilling & Fadel, 2009; Wagner, 2014; Zhao, 2009).

Table 1

*Educational System: Industrial vs. Information Age*

<table>
<thead>
<tr>
<th>Industrial age</th>
<th>Information age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organized as a production line to mass produce batches of standardized products (students)</td>
<td>Focus on teaching students how to learn, individualized and flexible</td>
</tr>
<tr>
<td>Students are passive receptors and consumers of knowledge</td>
<td>Students are active knowledge builders or producers</td>
</tr>
<tr>
<td>Knowledge is content</td>
<td>Knowledge is a process</td>
</tr>
<tr>
<td>Knowledge exists, is learned, and stored away for future use</td>
<td>Knowledge is developed to be replaced</td>
</tr>
<tr>
<td>Learning is individual, occurs in isolation</td>
<td>Learning is collaborative and occurs in the real world within a problem-based context</td>
</tr>
</tbody>
</table>


The Partnership for 21st Century Learning ([P21], 2003) noted, “Accelerating technological change, rapidly accumulating knowledge, increasing global competition and rising workforce capabilities around the world make 21st century skills essential” (p. 2). However, P21 also indicated there remains a gap between the skills taught in schools and the 21st-century skills needed to be a successful member of society. Furthermore, the integration of technology within the educational system has not been as evident as perceived by society (Busch et al., 2007). Instead of harnessing the experience of digital natives and incorporating technology into the everyday practices of teaching and
learning, the education system has marginalized technology as a learning tool (Busch et al., 2007; November, 2012).

Researchers have identified that the transition in K-12 public education within the 21st century is not due to a singular event but rather a culmination of economic, political, and cultural factors (Busch et al., 2007; OTA, 1982; P21, 2003; Summers, 2015; Trilling & Fadel, 2009; Wagner, 2014). However, the Internet and technological innovations have been two common threads within the factors of change.

**Technology in Education**

In order for students to be prepared for college and career, it is vital they have the skills to think critically, collaborate, be creative, and communicate their ideas and solutions to contribute and compete in a global society (Hart Research Associates, 2005; Kline & Williams, 2007; Robinson, 2015; Wagner, 2014). Technology is a natural and expected tool used by digital native students; however, in the K-12 public education setting, technology is often utilized to develop lower level computer skills rather than an integral component of the educational day (Busch et al., 2007; Prensky, 2001a, 2001b; Tapscott, 2009).

**History of Technology in K-12 Public Education**

Researchers and experts in the field have asserted technology integration is an essential component of 21st-century teaching and learning (Busch et al., 2007; Fouts, 2000; November, 2012; P21, 2003; Trilling & Fadel, 2009; USDE, 2004, 2008, n.d.). However, a review of the literature revealed the majority funding for educational technology in the United States focused mainly on technology resources rather than
technology integration (Busch et al., 2007; Culp et al., 2003; Fouts, 2000; Gray et al., 2010; National Center for Education Statistics [NCES], 2002; Ringstaff & Kelley, 2002).

**Past attempts to transform K-12 public education through technology.**

Computer technology became progressively important in the 1980s due to the explosion of the Internet, resulting in the educational system’s focus on building the infrastructure and increasing the number of computers in schools. The OTA (1982) asserted the increased demands for information technology, such as personal computers and the Internet, would greatly impact the teaching and learning within the K-12 public education system. In response to OTA’s prediction, the *Nation at Risk* report further supported the increased importance of technology in K-12 public education by calling for computer science to be a part of the core content taught to high school students (USDE, 1983). Then 20 years later, NCLB (2002) expanded on the *Nation at Risk* report and recommended every student be technologically literate by the eighth grade.

However, a report conducted in 2002 to understand the return on investment of technology in K-12 public education revealed that although expenditures had tripled on technology from 1990-2000, spending $6 billion dollars in 1999-2000, the placement of computers in classrooms did not yield educational reform (Ringstaff & Kelley, 2002). The report stated that the majority of districts and schools invested in technology without a clear vision or plan on how technology would be used to enhance instructional goals. Moreover, the report suggested that although it was important to have technology access and infrastructure, it was more imperative for teachers to receive additional training on how to integrate technology into their instructional delivery. The message to policymakers and educators was technology is a means to an end, not the end (Ringstaff
& Kelley, 2002). Furthermore, Culp et al. (2003) went a step further by stating teachers’ confidence with technology and their pedagogy affect the integration of technology within the educational system.

Student learning goals have also evolved as technology innovations have made the world more complex and interconnected (Culp et al., 2003). Although students need “high-level learning skills to act, respond, learn, and adjust to ever-changing circumstances” (Culp et al., 2003, p. 24), teachers indicated they mainly use the technology in their classroom for low-level tasks, such as word processing, e-mailing, and tracking attendance and grades (Busch et al., 2007; Culp et al., 2003; Earle, 2002; Gray et al., 2010; P21, 2003).

Researchers have posited that in order to effect change in K-12 public education, policymakers, districts, and schools need to address not only the issue of technology resources, access, and infrastructure but also more importantly, the technology processes and integration to truly transform teaching and learning (Busch et al., 2007; Culp et al., 2003; Ringstaff & Kelley, 2002). However, policymakers, districts, and schools continued to focus their funding on Internet access, infrastructure, computers, data systems, and training teachers to use the hardware and using technology for low-level tasks (Busch et al., 2007; Gray et al., 2010; USDE, 2004, 2008).

**Current trends to transform K-12 public education through technology.** The National Education Technology Plan (NETP) of 2010 recommended that in order for states, districts, and schools to prepare their students to be productive global citizens, technology should be leveraged to enable personalized, on-demand learning where critical thinking, collaboration, creativity, and communication, the 21st-century skills, are
woven into every content area (OET, 2010). Furthermore, the NETP stated educators and students needed Internet access and wireless connectivity to accomplish technology integration (OET, 2010). In 2012, the State Educational Technology Directors Association (SETDA) identified focus areas for states to transform teaching and learning that aligned to the recommendation established by NETP (see Table 2).

Table 2

**SETDA’s Four Focus Areas to Transform Teaching and Learning**

<table>
<thead>
<tr>
<th>Focus area</th>
<th>Definition</th>
</tr>
</thead>
</table>
| Infrastructure for learning             | • Broadband connectivity
                                            | • Comprehensive data system
                                            | • Common content standard to meet the needs of all students              |
| Educator effectiveness                  | • Professional development opportunities and resources to support educators in learning skills for an evolving global environment |
| Innovative learning models             | • Internet-ready devices
                                            | • Open educational resources
                                            | • On-demand, project-based online or blended learning settings            |
| College and career preparation         | • Integration of technology in all core curriculum areas
                                            | • Student access to online credit recovery or advanced courses
                                            | • Student use of hardware/software tools related careers and businesses |


Although the USDE and SETDA recommended not only focusing on infrastructure but also supporting educators to leverage technology to integrate the 21st-century skills into content areas to ensure students were college and career ready, the
federal government’s ConnectED initiative of 2013 aimed to ensure every student had high-speed Internet connectivity by 2018. Moreover, the NETP of 2016 acknowledged the educational system had made tremendous strides in closing the “digital divide,” to provide students with equal access to devices and Internet connectivity. However, a new divide evolved in “digital use—the disparity between students who use technology to create, design, build, explore, and collaborate and those who simply use technology to consume media passively” (Office of Educational Technology [OET], 2016, p. 18). Technology integration, striking a balance between the use of technology resources and practices in order to facilitate students’ learning of 21st-century skills, is a central concern for today’s K-12 public education system.

**Changing Demands in K-12 Public Education**

As innovative technology has continued to become more cost effective and Internet access is expected, the world has shrunk (Friedman, 2007). In addition, today’s students grew up with technology and Internet access, so they expect 24/7 access to information, instant communication with peers inside and outside the classroom’s four walls, and the freedom and choice to creatively express themselves in a global community (November, 2012; Prensky, 2001a, 2001b). Furthermore, since globalization and technology has transformed the way the United States has done business, the expectation of the workforce has changed. In general, Lotto and Barrington (2006) stated, students do not come into the workforce with the “applied skills” of critical thinking/problem solving, communication, collaboration/teamwork, and creativity/innovation in order to stay competitive in a global market place. Not only do students need these applied skills to be prepared for the workforce, according to Busch et
al. (2007), students require a broad and intense use of technology in K-12 public education to ensure they are digitally fluent in information, media, and communication (Lotto & Barrington, 2006). However, there continues to be a mismatch between the skills taught in K-12 public education and the skills demanded by the U.S. business community. An independent task force reported in 2012, “Technology is largely still being used to advance old-style teaching and learning with old-fashioned uses of human capital” instead of supporting the restructuring of schooling to promote the 21st-century skills (The Council on Foreign Relations, 2012, p. 33; Wagner, 2014). These factors resulted in many states, K-12 school districts, and schools to incorporate the P21 conceptual framework and the International Society for Technology in Education (ISTE) into their state standards (California Department of Education [CDE], 2014a, 2015; ISTE, 2008, 2016b; OET, 2016; P21, 2015).

**Conceptual Frameworks**

The changing demands of a global society, particularly in the last 6 years, has resulted in U.S. K-12 public education to reflect on its students’ preparation to be competitive critical thinkers, innovative creators, effective communicators, and collaborators in an ever-changing digital global society (Friedman; 2007; Friedman & Mandelbaum, 2011; Gunn & Hollingsworth, 2013; OET, 2016; Robinson, 2015; Wagner, 2012, 2014).

However, prior to effecting change at the school or classroom-level, a common understanding of the 21st-century skills needs to be established (Summers, 2015). In addition, districts and schools within the K-12 public education system need to be cognizant of teachers’ technology practices, their pedagogy of teaching and learning, to
support classroom technology integration in order to provide relevant and personalized learning experiences for students (Keengwe, 2007; Langham, 2014; Mishra & Koehler, 2006).

Although Voogt and Roblin (2012) identified eight 21st-century skill frameworks, for the purpose of this study the P21 framework was used along with the Technology Pedagogical Content Knowledge (TPACK) as the overarching conceptual frameworks. To foster critical thinking, creativity, communication, and collaboration within students, not only the 21st-century skills but also the impact of teachers’ beliefs and willingness to integrate technology into their teaching need to be taken into consideration (Fontanilla, 2015; Langham, 2014; Mishra & Koehler, 2006). Then the ISTE Standards for Students were used to focus this study on student expectations to acquire the skills needed in a 21st-century technology-integrated classroom (ISTE, 2016a).

**Partnership for 21st Century Learning**

The Partnership for 21st Century Learning (formerly the Partnership for 21st Century Skills) was established by a coalition of nonprofit and business organizations, educational leaders, and policymakers in 2002. The mission of P21 (2003) was to bring the 21st-century skills necessary for students to be prepared to lead and compete in a global workforce to the forefront of K-12 public education. In order to define the skills and knowledge essential for success in the 21st-century workforce, P21 developed a framework of the student outcomes and the support systems required to ensure students are prepared for future success in work and life. The P21 framework is graphical, represented by a rainbow of student outcomes and the skills and knowledge needed for success in the 21st century; the pool of ripples represents the alignment of the four
support systems vital to improvement in K-12 public education and student achievement (see Figure 1).


**Key subjects and 21st-century themes.** Since today’s students live and will work in an evolving, complex, technology-driven, and diverse world, the P21 framework explained that understanding of the key subjects, such as English language arts, mathematics, science, history/social sciences, and world languages are important. However, students also need a deeper grasp of how the core content areas are interconnected to the 21st-century themes of global awareness and literacy in finances and entrepreneurship, civics, health, and the environment in order to be productive global citizens (P21, 2003, 2015).

**Learning and innovation skills (4Cs).** Additionally, students need to acquire life-long learning skills in order to adapt to the changing demands of the world they live
Crockett et al. (2011) adapted futurist Alvin Toffler’s (1970) thoughts to explain, “The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn” (p. 17). P21 identified critical thinking, creativity, communication, and collaboration, also known as the 4Cs, as learning and innovation skills vital to students in order to adapt and thrive in a 21st-century society (P21, 2003, 2015).

**Critical-thinking skills.** The effective use of inductive and deductive reasoning along with the utilization of systems thinking, the ability to analyze how the whole and the parts of subsystems, systems, and complex system interact to produce results, are essential skills to support students’ critical thinking (P21, 2015). In addition, students need to be able to analyze, synthesize, and evaluate information to make informed decisions and self-reflect on their learning process (P21, 2015). Wagner (2014) explained critical thinking also involved asking the right question rather than memorizing the correct answer. Students need critical-thinking skills to understand concepts and then apply their understanding to solve relevant, real-world projects or problems (Kivunja, 2014b; Trilling & Fadel, 2009).

**Creativity.** Students must also have the skills to think and work creatively with others to implement innovations (P21, 2015). Furthermore, Robinson (2011) proposed creativity is “the process of having original ideas that have value” to society (p. 118). In order to cultivate creativity, students require a digital or nondigital learning environment where, Trilling and Fadel (2009) suggested, “questioning, patience, openness to fresh ideas, a high level of trust, and learning from mistakes and failures” (pp. 57-58) are welcomed (Crockett et al., 2011; Kivunja, 2014b; Trilling & Fadel, 2009; Zhao, 2015).
**Communication.** According to P21 (2015), students need to be able to “articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts” for several purposes (p. 4), through multimedia and technology to a diverse audience (Kivunja, 2014b; P21, 2015). Furthermore, Wagner (2014) elaborated, stating that communication skills were important to perpetuate a democratic citizenry and to communicate effectively in a diverse global community. Students will be expected to communicate clearly and concisely through face-to-face interaction, either physically or virtually, using a variety of tools to interpret, create, and convey meaning and products in an ever-increasing digital world (Trilling & Fadel, 2009).

**Collaboration.** P21 (2015) described collaboration as an individual’s ability to be flexible and respectful, value individual’s contributions, maintain shared responsibility of the workload in diverse teams while working toward a common goal. Crockett et al. (2011) found that students must also “possess the ability to collaborate seamlessly in both the physical and virtual spaces, with real and virtual partners globally” (p. 19). Collaboration can be facilitated in a classroom using cooperative learning groups that are composed of small, heterogeneous student teams who work interdependently to solve problems, while the teacher acts as a guide (Kivunja, 2014a; Plucker, Kennedy, & Dilley, n.d.). Cooperative learning tasks require adhering to three principles: (a) the task is designed around an engaging question or topic, resulting in team discussion, reflection, and comparison of peers’ perspectives, (b) the task causes students to be cooperative, (c) the task allows for both group and individual accountability (Frey, Fischer, & Everlove, 2009). Researchers recommended that to assess students’ collaborative
growth, districts, schools, teachers, and the cooperative learning teams themselves should evaluate both the collaboration process and outcome along with group and individual responsibilities (Frey et al., 2009; Plucker et al., n.d.).

**Information, media, and technology skills.** Today’s society lives in a digitally connected and media-driven environment. People have access to rapidly innovative and cheap technology and information, 24/7 (P21, 2015). Information has become disposable through the instantaneous connectivity to real-time events, resulting in information received in the morning to be outdated and inaccurate by later the same day (Crockett et al., 2011). Furthermore, the ability for individuals to collaborate digitally and contribute to the collection of information on the Internet has increased the importance of information; media; and information, communication, and technology (ICT) literacies for students in K-12 public education (P21, 2015).

Information fluency includes the efficient and effective access and evaluation of information, in all forms and formats, in order to use and manage information creatively and ethically (Crockett et al., 2011; P21, 2015). Students are digital natives, and the increased use of media has moved them toward communicating through visuals more than text (Crockett et al., 2011; Prensky, 2001a, 2001b). Therefore, students must be able to analyze media to understand its intent and purpose as well as to produce creative and ethical messages in a multicultural digital and real environment (P21, 2015). In addition, students require ICT literacy to apply technology tools appropriately and effectively to “access, manage, integrate, evaluate and create information to successfully function in a knowledge economy” (P21, 2015, p. 6).
**Life and career skills.** These skills are essential to “navigate the complex life and work environments in the globally competitive information age” (P21, 2015, p. 6). Students must be flexible and adaptable to constant change (P21, 2015; Wagner, 2014). In order to be adaptable, students also need to be self-directed learners and take initiative in developing their life and career goals. In addition, students’ future success in a globalized world is dependent on the ability to interact and work in diverse teams, both physically and virtually (P21, 2015; Wagner, 2014). Furthermore, students must be productive and accountable for the management and results of their projects while providing leadership and inspiration to their team and larger community (P21, 2015).

**21st-century support systems.** In order for students to be successful with the 21st-century outcomes defined by P21, four support systems must be aligned and in place: standards and assessments; curriculum and instruction; professional development; and a creative, safe learning environment (P21, 2015). The standards need to interweave content knowledge with 21st-century skills. In addition, formative and summative assessments need to be performance based to guide instruction, while student portfolios would measure growth in 21st-century skills over time. Moreover, it is essential to integrate the 21st-century skills into the curriculum and instruction, while providing students a choice in the application of their learning by producing creative projects to real-world, relevant problems. Similarly, according to P21 (2015), professional growth for teachers needs to demonstrate how to “seize opportunities for integrating 21st-century skills, tools and teaching strategies into their classroom practice—and help them identify what activities they can replace/de-emphasize” and illustrate how “deeper understanding of subject matter can actually enhance problem-solving, critical thinking, and other 21st
century skills” (p. 8). Finally, the 21st-century learning environment must support professional learning communities for teachers to collaborate around the integration of 21st-century skills into their classroom practice, provide equal access to digital and nondigital learning tools and technology, and design classrooms to optimize various configurations to support group and individual learning (P21, 2015).

Researchers and experts in the field agree the 21st-century skills must be taught by interweaving technology into K-12 public education classroom practices to ensure students are prepared to be successful in life Culp et al., 2003; Ertmer et al., 2012; Gunn & Hollingsworth, 2013; Hanover Research, 2016; Mishra & Koehler, 2006). However, many researchers also assert that the transformation of teaching and learning is stymied by teachers’ pedagogy or beliefs concerning technology integration in the classroom (Culp et al., 2003; Ertmer et al., 2012; Gunn & Hollingsworth, 2013; Hanover Research, 2016; Mishra & Koehler, 2006).

**Technology Pedagogical Content Knowledge**

As technology integration became more prevalent in K-12 public education, researchers found access to classroom technology and an established understanding of the 21st-century skills were not sufficient to effect change in student outcomes (Culp et al., 2003; Earle, 2002; Fontanilla, 2015; Gray et al., 2010; OET, 2016; P21, 2015; Summers, 2015). Researchers asserted it was equally important to address teachers’ pedagogy and beliefs in order to leverage technology to integrate the 21st-century skills or the 4Cs into their teaching practices to ensure students acquired the skills needed to thrive in a global society (Fontanilla, 2015; Hanover Research, 2016; Keengwe, 2007; Koehler & Mishra, 2009; Langham, 2014; Mishra & Koehler, 2006).
The TPACK framework evolved from Lee Shulman’s pedagogical content knowledge (PCK) construct to include technology (Koehler & Mishra, 2009). The TPACK framework describes the three main types of teachers’ knowledge: content, pedagogy, and technology (Koehler & Mishra, 2009; Mishra & Koehler, 2006). It also explains the importance for teachers not only to understand these knowledges but also to know how these types of knowledge work interdependently to create new knowledge to affect pedagogical practice in relation to technology integration in classroom instruction (Fontanilla, 2015; Hanover Research, 2016; Howell, 2012; Koehler & Mishra, 2009; Mishra & Koehler, 2006). Figure 2 illustrates the complex relationship between the three knowledge types, which ultimately created seven types of knowledge for teachers to utilize in a flexible manner to integrate technology successfully into their teaching practices. The seven new types of knowledge are categorized as content knowledge (CK), pedagogical knowledge (PK), pedagogical content knowledge (PCK), technology knowledge (TK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and technological pedagogical content knowledge (TPACK).

Past research revealed access to classroom technology and the identification of the 21st-century skills to be taught, through technology integration, were necessary to prepare students to be productive global citizens but were not sufficient (Busch et al., 2007; Friedman; 2007; Friedman & Mandelbaum, 2011; Gray et al., 2010; Gunn & Hollingsworth, 2013; OET, 2016; P21, 2003, 2015; Robinson, 2015; Wagner, 2012, 2014). Other studies contended the importance of establishing common definitions or
Figure 2. TPACK framework. Reproduced by permission of the publisher, © 2012 by tpack.org.

framework to guide K-12 public education districts, schools, and classrooms in the integration of 21st-century skills and technology into the classroom (P21, 2003, 2015; Summers, 2015; Trilling & Fadel, 2009). Moreover, other researchers recognized that teaching and learning would not change in K-12 public education classrooms unless districts, schools, and teachers understood the intricate relationship between TPACK and then used this knowledge appropriately to successfully integrate technology in the teaching and learning of the 21st-century skills (Fontanilla, 2015; Hanover Research, 2016; Howell, 2012; Koehler & Mishra, 2009). Other researchers asserted that teachers
require established student performance indicators in order to adjust their instruction to support students’ acquisition of the 21st-century skills (ISTE, 2008, 2016a, 2016b).

**International Technology Standards for Students**

In response to K-12 public education’s continued focus on technology resources, such as Internet access, tools, and applications, the ISTE developed Standards for Students, which are aligned to the P21 framework. In 2016, the most recent edition of the *ISTE Standards for Students* aimed to prepare students to be “agentic, future-focused, and adaptable” (ISTE, 2016a, p. 2) and be successful in an ever-changing global environment (ISTE, 2008, 2016a, n.d.; P21, 2009). The focus and purpose of the seven ISTE student standards—empowered learner, digital citizen, knowledge constructor, innovative designer, computational thinker, creative communicator, and global collaborator—were to have students actively become the owners of their learning and also to provide measurable performance indicators for both students and teachers to monitor students’ acquisition of the 21st-century skills (see Figure 3).

P21 provided K-12 public education with common definitions for critical thinking, collaboration, creativity, and communication skills that researchers and business leaders deemed necessary for students to be future productive global citizens (Friedman, 2007; Friedman & Mandelbaum, 2011; Hart Research Associates, 2005, 2013; Lotto & Barrington, 2006; Robinson, 2015; Wagner, 2012; 2014). Other researchers added to the literature, explaining that in order to make a deep impact on the teaching and learning in the 21st century classroom, K-12 public education must also take into account the TPACK of classroom teachers to effectively integrate technology to teach the 21st-century skills (Howell, 2012; Koehler & Mishra 2009; Mishra & Koehler, 2006).
Furthermore, ISTE (2016a) asserted that its new *Standards for Students* are about pedagogy and not tools. Moreover, the new *ISTE Standards for Students* not only incorporated the 21st-century skills but also established students as the owners of their learning through technology integration. The shift to students becoming self-directed learners has caused teachers to rethink their role in the 21st-century classroom.

![Image of ISTE standards](http://www.iste.org/docs/pdfs/20-14_ISTE_Standards-S_PDF.pdf)

*Figure 3. International Society for Technology in Education (ISTE) standards for students. Reproduced from *ISTE standards for students*, by International Society for Technology in Education, 2016a, retrieved from http://www.iste.org/docs/pdfs/20-14_ISTE_Standards-S_PDF.pdf*

**Fostering the 21st-Century Skills in a 1:1 Classroom: The Teacher’s Role**

Researchers have explained that teachers in today’s K-12 public schools are faced with several major trends that challenge their established practice and pedagogy, such as
increasing availability and use of information and communication technologies and the call for the teaching of 21st-century skills and learning (Crockett et al., 2011; Hammett, 2007; Wagner, 2014). In order to meet society’s demands and support students’ future success, teachers must understand the interrelationship between their pedagogical, content, and technology knowledge to ensure they are fostering the development of critical thinking, creativity, collaboration, and communication skills in their students (Howell, 2012; ISTE, 2016b; Kivunja, 2014a; Koehler & Mishra, 2009; Mishra & Koehler, 2006; Trilling & Fadel, 2009).

**Digital Immigrants and Natives**

Researchers have described many classroom teachers as digital immigrants who do not understand how digital natives learn (Crockett et al., 2011; November, 2012; Prensky, 2001a, 2001b, 2007; Tapscott, 2009). For instance, Prensky (2007) explained digital natives, or today’s students. Although digital immigrants perceive their information presentation via PowerPoint or supporting students in developing their technical computer skills as a segue into the digital natives’ world, in actuality this practice solidifies the mindset of digital immigrants: technology is a supplemental teaching tool (Ertmer & Ottenbreit-Leftwich, 2010). Prensky (2007) further explained that in the new learning environment the digital immigrant teachers must adapt their role in the classroom to become a coach and a learner alongside their students, rather than perceiving themselves as a bank of knowledge, transferring content to receptive students. Otherwise, as other researchers have clarified, digital natives who have instant access to information and content on their smartphones will becoming increasingly disengaged in
school and possible drop out because classroom teaching is no longer relevant to current reality (Kivunja, 2014a, 2014b; November, 2012).

Teacher- Versus Student-Centered Teaching

Today’s teachers must also understand the 21st-century skills needed to be taught in the ever-increasing digital learning environment. Researchers have explained the teaching of the 21st-century skills includes a shift from a teacher-directed to a personalized, student-centered learning environment where critical thinking, communication, creativity, and collaboration skills are integrated, along with technology, into content areas. Moreover, in this 21st-century learning environment, students are presented with problem-based scenarios centered on relevant real-world problems and are expected to produce collective and creative solutions (Kivunja, 2014a, 2014b; Trilling & Fadel, 2009). As recently as 2015, the New Media Consortium (NMC) Horizon Report stated that K-12 public education districts, schools, and classroom teachers must redesign their model of schooling to bolster student engagement, nurture innovation, and cultivate an environment where students own their learning (Johnson, Adams Becker, Estrada, & Freeman, 2015). Zhao (2015) concurred, asserting there are two educational paradigms: employee orientated versus entrepreneurial orientated, and teachers must abandon the old employee-orientated paradigm to ensure students are equipped to thrive in a diverse global society (see Table 3). However, the majority of teachers continue to believe they are the keepers of knowledge and their job is to impart the content to students through in-person lectures in a one-size-fits-all learning environment (November, 2012; Prensky, 2007; Saavedra & Opfer, 2012).
Table 3

**Education Paradigms**

<table>
<thead>
<tr>
<th>Employee-orientated characteristics</th>
<th>Entrepreneurial-orientated characteristics</th>
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<tr>
<td>• Knowledge and skills predetermined and transmitted</td>
<td>□ Knowledge and skills evolve based on individual needs</td>
</tr>
<tr>
<td>○ Based on predictive societal and economic needs</td>
<td>○ Assumes individual becomes valuable as knowledge and skills grow</td>
</tr>
<tr>
<td>• Values what students <em>should</em> learn</td>
<td>• Values what students <em>would</em> learn</td>
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**Professional Development**

Researchers, therefore, explain that teachers need support to integrate the 21st-century skills and technology into their classroom practices through professional development that addresses how to interweave teachers’ pedagogical and content knowledge along with technology (Ertmer & Ottenbreit-Leftwich, 2010; Ertmer et al., 2012; Mishra & Koehler, 2006; Rotherham & Willingham, 2009).

The TPACK framework promotes teachers’ reflections on their technology selection when delivering content to ensure the integration supports the learning in classrooms (Mishra & Koehler, 2006). According to Ertmer and Ottenbreit-Leftwich (2010), teachers also need professional development to “understand how to use technology to facilitate meaningful learning, defined as that which enables students to construct deep and connected knowledge, which can be applied to real situations” (p. 257). In addition, the professional development needs to improve teachers’ technology skills within the context of their own specific content, using the same technology tools.
teachers have in the classroom in order to increase teachers’ confidence and efficacy, resulting in a higher degree of technology integration in the classroom (Ertmer & Ottenbreit-Leftwich, 2010; Ertmer et al., 2012). Furthermore, today’s teachers need to establish professional learning networks (PLNs) to engage in continual and collaborative discussions with educators from around the nation and the world in order to be kept up-to-date on new Web 2.0 technologies and continue to grow professionally (Ertmer et al., 2012).

Although the TPACK framework has provided professional developers and teachers with guidelines to integrate technology with pedagogical and content knowledge, it has neglected to delve deeper into the integration of the 4Cs: critical thinking, collaboration, creativity, and communication (Mishra & Koehler, 2006). The P21 (2015) framework has defined critical thinking, collaboration, creativity, and communication as necessary skills needed for students to be future ready. To further support teachers’ adaption to a 21st-century teaching and learning environment, the ISTE developed standards for both teachers and students (ISTE, 2008, 2016a). The ISTE standards serve as guides for teachers to integrate the 4Cs and technology into any content area.

Likewise, a new certification to further assist teachers with the integration of the 4Cs and technology into their pedagogical and content knowledge has been developed, the Leading Edge Certificate (LEC) for digital educators (LEC, n.d.-a). The LEC is the first national certification program incorporating educational technology and curriculum innovation. It was developed by an alliance that was established in 2010. The alliance includes nonprofits, universities, and educational and governmental agencies whose
objective is the advancement of student achievement. The LEC for digital educators is aligned to the NETP, the CCSS, and the ISTE standards (Leading Edge Certification, n.d.-b). The learning modules within the Digital Educator LEC include topics relevant to building teachers’ awareness of pedagogy and then developing teachers’ understanding through application of the 21st-century skills and technology into their content areas (see Figure 4).

Furthermore, the certificate and learning modules strive to emulate the 21st-century teaching and learning environment. The majority of the course is conducted in an online environment; participants are encouraged to think critically, communicate, and collaborate. At the end of the course, they must successfully create a digital portfolio that exemplifies their learning in order to receive their certification (LEC, n.d.-b).

<table>
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<th>Curriculum Outline</th>
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<tr>
<td>Introduction</td>
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<td>Pedagogy</td>
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<td>Digital Literacy &amp; Citizenship</td>
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<td>Data Literacy</td>
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<td>Curation &amp; Creation</td>
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<tr>
<td>Communication &amp; Collaboration</td>
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<tr>
<td>Learning Environments</td>
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<td>Portfolio &amp; Closure</td>
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</table>

The Leading Edge certification for the digital educator is a national certification program to promote the understanding of how the integration of the 4Cs and technology change the teaching and learning (Leading Edge Certification, n.d.-a). The tenets of the Digital Educator LEC support teachers in fostering the 21st-century skills of critical thinking, collaboration, creativity, and communication in their students.

Summary

The review of literature reveals there is a pressing need for today’s students to be critical thinkers and to have the ability to collaborate with diverse groups of people (AEE, 2015; Friedman, 2007; Friedman & Mandelbaum, 2011; Hart Research Associates, 2013; Kline & Williams, 2007; Lotto & Barrington, 2006; Wagner, 2012, 2014). In addition, in order to be successful in a globalized, digital world, today’s students also need to be able to communicate effectively and to be creative innovators.

Furthermore, researchers and experts in the field have asserted technology integration is an essential component of 21st-century teaching and learning (Busch et al., 2007; Fouts, 2000; November, 2012; P21, 2003; Trilling & Fadel, 2009). Several studies and reports have indicated that federal and state governments along with districts and schools have allocated major funding to promote technology education (Busch et al., 2007; Culp et al., 2003; Fouts, 2000; Gray et al., 2010; Ringstaff & Kelley, 2002). However, the focus of the funding was on increasing technology resources, such as Internet access and infrastructure, rather than technology integration (Busch et al., 2007; Culp et al., 2003; Fouts, 2000; Gray et al., 2010; Ringstaff & Kelley, 2002). Therefore, the narrow focus on technology resources has resulted in little impact on the teaching and learning environment in today’s classrooms as teachers continue to utilize technology as
an administrative tool or for low-level tasks such as word processing or presentation of information, instead of integrating technology into their content area (Gray et al., 2010; Mishra & Koehler, 2006; Prensky, 2007).

More recently, researchers have indicated the need for professional development for teachers to understand how their own educational beliefs, instructional process, and content knowledge can be infused with technology to support the teaching and learning of the 21st-century skills (Ertmer & Ottenbreit-Leftwich, 2010; Ertmer et al., 2012; Keengwe, 2007; Mishra & Koehler, 2006). In response, several frameworks were developed to encourage and guide districts, schools, and teachers in facilitating the teaching and learning of the 21st-century skills of critical thinking, collaboration, creativity, and communication in today’s digital classrooms (ISTE, 2016a; Mishra & Koehler, 2006; P21, 2015).

As the examination around the preparation of K-12 public education students to be productive global citizens continues, there remains an urgent need to assist teachers in the integration of technology and the fostering the 21st-century skills into their teaching. Although extensive research and reports have been conducted on technology education and teachers’ technological pedagogical knowledge content awareness and the integration of technology within teaching, a gap was identified on the specific practices teachers use to integrate technology in their classrooms. Fontanilla’s (2015) study suggested a qualitative study be conducted to describe teachers’ perceptions on the teaching/instructional practices used to integrate technology to complement the quantitative ratings yielded from teachers’ self-assessment of their degree of technology integration in the classroom. Moreover, there is little evidence on teachers’ perceptions
of instructional practices used to not only integrate technology but more importantly to facilitate critical thinking, collaboration, communication, and creativity into their one-to-one classroom to ensure today’s students are prepared to thrive in a global society.
CHAPTER III: METHODOLOGY

Overview

This chapter describes the methodology that was used for the study. The research purpose statement and research questions are presented in order to establish the basis for the study. This qualitative study used a phenomenological approach to describe elementary school teachers’ perceptions regarding what instructional practices facilitate students’ development of critical thinking, collaboration, communication, and creativity (4Cs) in one-to-one computer classrooms. Data were collected through interviews and artifact analysis. The population and sample are defined and identified. The data collection and analysis protocols are explained, and the limitations of the research design are acknowledged.

Purpose Statement

The purpose of this phenomenological study was to describe the perceptions of current and former Leading Edge Certified (LEC) elementary school teachers regarding instructional technology practices that facilitate students’ development of critical thinking, collaboration, communication, and creativity (4Cs) in one-to-one computer classrooms in Riverside County, California.

Research Questions

This study was guided by one central question. The central question was divided into four subquestions

Central Question

What are the lived experiences of current and former Leading Edge Certified (LEC) elementary school teachers in facilitating students’ learning of critical thinking,
collaboration, communication, and creativity skills through technological instructional practices in one-to-one classroom?

**Subquestions**

1. What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate critical thinking in their one-to-one classroom?

2. What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate collaboration in their one-to-one classroom?

3. What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate communication in their one-to-one classroom?

4. What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate creativity in their one-to-one classroom?

**Research Design**

This qualitative study used a phenomenological approach to describe elementary school teachers’ perceptions regarding what instructional technology practices facilitate students’ development of critical thinking, collaboration, communication, and creativity (4Cs) in one-to-one computer classrooms. Data were collected through interviews and artifact analysis.

In qualitative research, the researcher seeks to describe how people make sense of their world and uses open-ended inquiry methods to collect data in the form of peoples’ narratives and artifacts (Patton, 2015). In this study, the phenomena include the description of certified LEC elementary school teachers’ lived experiences in facilitating
the learning of the 21st-century skills—critical thinking, collaboration, communication, and creativity (4Cs)—in their students. The qualitative researcher then analyzes the data to discover emergent themes to better understand the phenomena being studied (McMillan & Schumacher, 2010). According to McMillan and Schumacher (2010), there are nine characteristics of qualitative research (see Table 4). These characteristics guide the qualitative researcher’s practice.

Table 4

<table>
<thead>
<tr>
<th>Nine Characteristics of Qualitative Research</th>
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<td>Characteristic</td>
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<td>Natural setting</td>
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<td>Contextual sensitivity</td>
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<td>Direct data collection</td>
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<tr>
<td>Rich narrative description</td>
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<tr>
<td>Process orientation</td>
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<tr>
<td>Inductive data analysis</td>
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<tr>
<td>Participants perspectives</td>
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<tr>
<td>Emergent design</td>
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<td>Complexity of understanding and explanation</td>
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Qualitative methodology provides a flexible, in-depth exploration of a phenomenon. According to Patton (2015), a phenomenological approach within a
A qualitative phenomenological approach was selected for this study. The phenomena under study were the perceptions of LEC elementary school teachers regarding what instructional technology practices facilitate students’ development of the 4Cs in one-to-one computer classrooms. A phenomenological approach was best suited to capture the participants’ “lived experiences” and explore their perceptions to answer the study’s research questions, through conducted in-depth interviews and the collection of artifacts (Patton, 2015, p. 115).

Population

A population is a group that “conforms to specific criteria” in which research results can be generalized (McMillan & Schumacher, 2010, p. 129). The population for this study consisted of certified LEC digital educators (teachers) in California. The study’s population included those educators who taught in public unified and/or elementary districts and who were granted a LEC certification after successful completion of a digital portfolio with technology-enhanced projects demonstrating learning activities that encourage students to think critically, communicate, collaborate, and create. It excluded educators from private or charter schools. According to
E. Walters (personal communication, November 9, 2016), Program Coordinator for LEC, there were 2,180 certified LEC digital educators in California at the time of the study.

**Target Population**

According to Creswell (2014), the target population is the “actual list of sampling units from which the sample is selected” (p. 393). The target population for this study was elementary teachers with the Digital Learning LEC who worked in public unified or elementary school districts within Riverside County, California (see Figure 5). There are 35 Digital Learning LEC-certified elementary teachers in Riverside County, California.

![Figure 5](image)

**Figure 5.** Defining the target population.

**Sample**

A sample in a qualitative study is naturally small, and in contrast to quantitative probabilistic sampling, the sampling is purposeful, as Patton (2015) stated, “selecting
information-rich cases for in-depth study” (p. 264). The researcher used a combination of purposive sampling and convenience sampling to construct the sample for this study. The sample for this study was 12 elementary teachers in Riverside County, California who hold a Digital Educator Leading Edge Certificate.

McMillan and Schumacher (2010) explained that purposeful sampling provides researchers a selection of “particular elements from the population that will be representative or informative about the topic of interest” (p. 138). The strategy employed to identify the participants was criterion sampling based on the research problem, purpose, and questions. The criterion sampling method allowed the researcher to select participants based on specific criteria (Patton, 2015). The following criteria were established to select eligible participants for this study:

1. Teachers were employed at an elementary school in Riverside County, California
2. Teachers held a Digital Educator Leading Edge Certificate
3. Teachers taught in a unified or elementary school district
4. Teachers used individual electronic devices within their classrooms

In addition, the convenience sampling strategy allows a qualitative researcher to establish an accessible sample based on location and time (Marshall, 1996; Patton 2015). In this study, the convenience sampling strategy was simultaneously applied with the purposeful sampling strategy to identify participants who met the criteria and were located in close proximity to the researcher’s location (Marshall, 1996; Patton 2015).

Sample Selection Process

The sample size of qualitative research is based on the purpose, questions, and design of the research (Patton, 2015). In addition, the validity of qualitative inquiry is
more dependent on the richness of the information collected than the number of the sample size (Patton, 2015). Since the purpose of this research was to describe the perceptions of current and former Leading Edge Certified elementary school teachers regarding what instructional practices facilitate students’ development of critical thinking, collaboration, communication, and creativity (4Cs) in one-to-one computer classrooms, a small sample size was used to ensure in-depth interviews were conducted to collect information-rich narratives to describe the phenomena. The following process was used to select participants:

1. A list of teachers holding LEC certificates in Riverside County was obtained from the Riverside County Office of Education (RCOE).

2. The researcher contacted administrators within elementary and unified school districts in Riverside County by phone to secure an agreement to interview potential participants.

3. Teachers who met the selection criteria were identified with the help of RCOE and participating districts.

4. After the 12 participants were selected using purposeful criteria and convenience sampling, participants were contacted via phone and e-mail by the researcher. A letter of invitation that described the selection criteria, purpose, procedures, and risks involved in participation was included as an attachment in the e-mail (see Appendix B).

5. If a participant refused participation, a replacement was selected based on criteria and proximity to researcher.
6. After participants agreed to be interviewed, they were provided with a participants’ bill of rights and informed consent documents (see Appendices C and D).

**Instrumentation**

In qualitative inquiries, the researcher is the main instrument for data collection (Patton, 2015). Therefore, it is important for qualitative researchers to be highly trained in the methodology of interviews, observation and analysis of artifacts, and to be reflective and sensitive to self-bias in order to preserve the integrity of the study (Merriam, 1988; Patton, 2015). Therefore, in this phenomenological study, the researcher included several safeguards during interviews and artifact review to deter researcher bias and produce a reliable and valid study.

The primary instrument used in this study was standardized open-ended interviews (McMillan & Schumacher, 2010; Patton, 2015). In this approach, an interview schedule was established before interviews were conducted. Prior to conducting the interviews, all participants received the participants’ bill of rights (see Appendix C) and provided signed informed consent (see Appendix D). The interview questions were predetermined, based on the research questions, variables of the study, and the review of literature, with special emphasis on the seven domains of the International Society for Technology in Education ([ISTE], 2016a) standards for students. The *ISTE Standards for Students* provide teachers and students learning targets to ensure students acquire the 21st-century skills needed for success in college and/or career and include the following seven domains: (a) empowered learner, (b) digital citizen, (c) knowledge constructor, (d) innovative designer, (e) computational thinker, (f) creative communicator, (g) global collaborator (ISTE, 2016a).
The questions were also carefully worded to focus participants’ toward describing the phenomena. The use of an interview protocol (see Appendix E) and the same questions for each participant in the standardized open-ended interviews (see Appendix F) also provided a consistent structure to allow for quality review and future replication (McMillan & Schumacher, 2010; Patton, 2015).

**Reliability**

Reliability is promoted through a consistent and standardized data collection process (McMillan & Schumacher, 2010; Patton, 2015). Furthermore, in qualitative studies, the researcher is the data collection instrument.

In this study, to promote reliability, the researcher conducted all the face-to-face interviews and used the same interview protocol for all participants’ interviews to ensure consistency (see Appendices E and F). Moreover, the reflexivity was utilized to increase reliable results. Reflexivity is the conscious practice of self-reflection by the researcher to ensure the limitation of human bias (McMillan & Schumacher, 2010; Patton, 2015). The researcher in this study employed the following strategies to limit subjectivity and self-bias: a peer debriefer, a colleague without interest in the topic of study who discussed and asked questions of the researcher to ensure the researcher was aware of her role in the inquiry process, and a field log to chronologically record when data sets were collected (McMillan & Schumacher, 2010).

In addition, intercoder reliability was utilized to ensure code consistency (Lombardi, Snyder-Duch, & Bracken, 2010). The researcher established the following coding protocol with two colleagues familiar with but not a part of the study:
Step 1: Primary researcher selected to code responses for five participants on the same interview question.

Step 2: During the first read of the data, the researcher noted possible data segments in the margins (McMillan & Schumacher, 2010; Patton, 2015).

Step 3: Primary researcher reflected on the meaning of the specific data segments and assigned a code, based on the research questions and the six domains of the *ISTE Standards for Students* (ISTE, 2016a).

Step 4: Primary researcher employed the NVivo qualitative data analysis software to code the same interview question from five participants.

Step 5: Primary researcher provided the established themes to two colleagues familiar with but not a part of the study.

- Step 6: The two colleagues reviewed the five participants’ responses to the same interview question to confirm the established themes. If discrepancies were discovered, a conversation took place between the primary researcher and the two colleagues to reconsider coding themes.

Step 7: Two colleagues coded the data using the established themes and then returned information back to the primary researcher.

Step 8: Primary researcher compared the results for consistent coding frequencies (Lombardi et al., 2010).

To further increase reliability, the researcher presented the interview questions to a panel of experts to review the content of the interview questions (see Appendices G and H), and then the interview questions were pilot tested with four educators who met the
selection criteria to ensure the trustworthiness of the interview questions to draw out meaningful data to answer the research questions.

**Pilot Test**

Prior to conducting the study, a panel of four educators was asked to field-test the interview schedule and questions. A pilot test increased reliability in this study by safeguarding the neutrality of the researcher and ensuring that the questions accurately aligned to the research questions, and provided an opportunity for revisions to the interview schedule and/or questions prior to the actual collection of data (Creswell, 2014; McMillan & Schumacher, 2010). Pilot test participants were asked to review the interview schedule (see Appendix E) and the interview questions (see Appendix F) and to provide feedback on the following areas: structure, sequence, and reliability of interview questions; the clarity of interview questions; length of questions and interview; and the recording process. Revisions were made based on the feedback from the pilot test participants and the dissertation committee.

**Validity**

In qualitative research, validity requires the researcher and the participants to establish a common understanding of the concepts and phenomena under study (McMillan & Schumacher, 2010; Patton, 2015). In this study, to enhance validity the following strategies were employed: participants’ language, mechanically recorded data, and participant review. The participants’ language was used to design clear and concrete interview questions in familiar language to the interviewees. In addition, the researcher provided the participants with working definitions of the 4Cs. An established common understanding of these terms ensured comprehension of the interview questions and
informed targeted participants’ responses (McMillan & Schumacher, 2010; Patton, 2015). Moreover, a mechanical recording device was used during participants’ interviews to ensure a verbatim collection of participants’ words rather than relying on the researcher’s written account and memory (McMillan & Schumacher, 2010; Patton, 2015). Finally, participants were provided the opportunity to review the transcription of their interview to verify their experiences were accurately captured.

**Data Collection**

Patton (2015) described the interviewing process as the gateway into another’s perspective and that others’ perspectives are “meaningful and knowable and can be made explicit” (p. 426). The purpose of this qualitative study was to describe the perceptions of current and former Leading Edge Certified elementary school teachers regarding what instructional technology practices facilitate students’ development of critical thinking, collaboration, communication, and creativity (4Cs) in one-to-one computer classrooms. Therefore, interviews were the primary method of data collection. In addition, artifacts such as student work samples were collected to support the triangulation of data (McMillan & Schumacher, 2010).

**Human Subject Considerations**

Prior to data collection, the research design and interview protocols were approved by the Brandman University Institutional Review Board (BUIRB) to protect the rights of participants (McMillan & Schumacher, 2010; Patton, 2015; see Appendices I and J). A formal invitation was sent to prospective participants via e-mail and included the purpose of the study and a description of the established protocols, so participants understood the extent of their commitment in joining the study (see Appendix B). After
participants accepted being a part of the study, they were provided an electronic copy of the Brandman University “Research Participant’s Bill of Rights” via e-mail (see Appendix C). In addition, prior to participation, participants were provided an informed consent form that included the title of the research study, the purpose of the research, a description of the study’s procedures, the risks and benefits of participation, permission to use an audio recorder, the option to review one’s transcription, the request of teacher lesson plans and/or work samples, and the contact information of the researcher (see Appendix D). The completed consent forms were housed in the researcher’s office in a password-protected safe, and a signed copy was provided to individual participants.

The confidentiality of both the participants and their work location was protected (McMillan & Schumacher, 2010; Patton, 2015). Since the sampling method included recommendations from professionals in the field, the identity of individual participants and their worksite could have been recognized. Therefore, the researcher and the dissertation committee chair only knew the names and work locations of participants. Furthermore, prior to interviewing, participants were guaranteed confidentiality of all information shared, and the following safeguards were explained: names and locations would be generalized in the participants’ transcription to protect identity; audio recordings were password protected and would be destroyed after transcriptions were completed.

**Interview Procedures**

Each interview followed the same protocol to ensure consistency. The researcher contacted the participant, via e-mail, several days prior to the scheduled interview time to confirm date, time, and location. In addition, the e-mail included the following portable
Eleven of the interviews were conducted face-to-face at a public location selected by the participant, and one interview was conducted over the phone using the same interview schedule protocol (see Appendices E and F). To begin the interview, the researcher introduced herself and engaged the participant in some informal conversation to establish rapport. The researcher then explained the purpose of the research and reviewed the informed consent, Brandman University Participant’s Bill of Rights, and audio release forms (see Appendices D, C, and L). Next, the researcher verified the informed consent form paperwork was completed and provided the participant an opportunity to ask clarifying questions regarding the research and/or interview process. At this time, the researcher reaffirmed the use of the audio recording and started recording the interview.

Prior to asking the first interview question, the researcher reminded the participant that he or she could end the interview at any time and/or decline to answer any interview questions. Throughout the interview, the researcher took notes to formulate possible follow-up questions to support future data analysis and took a written back up to the audio recording (Patton, 2015). The interview schedule was divided into three sections: (a) background information; (b) past and present experiences with the development of critical thinking, collaboration, communication, and creativity (4Cs) in a one-to-one computer classroom; and (c) overall conclusions. During the interview, the researcher would ask follow-up or probing questions to improve understanding of the participant’s
perception of instructional strategies that facilitated the development of the 4Cs in students. At the conclusion of the interview, the researcher asked the participant if there was any additional information he or she wanted to add concerning instructional strategies that facilitated the development of the 4Cs in their students. After the participant’s response was recorded and noted, the researcher thanked the participant for his or her time, formally concluded the interview, and stopped the audio recording.

The researcher also requested participant’s lesson plans and/or student work samples as artifacts of instructional strategies used to facilitate the development of the 4Cs in students. During the informed consent process, participants were notified that copies of lesson plans and/or student work samples would be requested as part of the study. Toward the beginning of the interview, the participants were asked to provide their lesson plans and/or students’ work samples so they could be referenced during the interview process. In order to protect the identity of participants and their students, the researcher redacted any mention of names from the lesson plan and/or lesson plans.

**Data Analysis**

In qualitative research, inductive data analysis is used to systematically collect, code, and categorize emerging patterns and/or themes and then interpret the data to describe the phenomena under study (McMillan & Schumacher, 2010; Patton, 2015). These steps are fluid and the researcher often moves between them throughout the data analysis process.

**Data Coding**

After the data were collected and transcribed, the researcher then began to code the data based on the research questions and the conceptual framework of the *ISTE*
Standards for Students. During the first read of the data, the researcher noted possible data segments in the margins (McMillan & Schumacher, 2010; Patton, 2015). Then the researcher reflected on the meaning of the specific data segments and assigned a code. Next, the researcher employed the NVivo qualitative data analysis software to code the transcriptions, lesson plans, and the student work samples.

Throughout the coding process, the researcher reviewed the codes to refine the coding system to ensure accuracy, comprehensiveness, and unduplicated codes (McMillan & Schumacher, 2010; Patton, 2015). In addition, two colleagues familiar with but not a part of the study coded the data independently as an intercoder reliability measure. This measure was included as a means of minimizing the impact of researcher bias on the data analysis process.

Categorizing and Identifying Themes

During the coding process, categories of related codes emerged into themes. McMillan and Schumacher (2010) explained the main goal of qualitative research is to “identify a pattern among various categories to establish a relationship” (p. 378). In this study, after a potential pattern was identified, the researcher used triangulation to verify authenticity through the comparison of interviews, lesson plans, and student work to detect a recurrence of the pattern (McMillan & Schumacher, 2010).

Throughout the data analysis process, qualitative researchers practice reflexivity to promote credibility. For this study, the researcher used continual self-reflection of her personal bias and its impact on the collection and coding of data (McMillan & Schumacher, 2010; Patton, 2015). In this study, the researcher was a coordinator of digital learning in a K-12 unified school district in Riverside County in California.
Again, two colleagues familiar with but not a part of the study coded the data independently as an intercoder reliability measure. This measure was included as a means of minimizing the impact of researcher bias on the data analysis process.

**Depiction of the Findings**

Qualitative data consist of words, observations, and documents (McMillan & Schumacher; Patton, 2015). In order to effectively describe and interpret participants’ lived experiences in a phenomenological study, the researcher uses “thick descriptions” to report the findings so others can understand the context, details, and emotions of the participants’ perceptions of the phenomena (McMillan & Schumacher, 2010; Patton, 2015). This study used thick, vivid textual descriptions in the presentation of the data. In addition, visual displays are often employed to further support the interpretation and demonstrate patterns in the data to the reader (McMillan & Schumacher, 2010; Patton, 2015). For this study, tables were used to arrange data, such as frequency counts of codes for easy interpretation for the reader, accompanied by narrative explanations of the data to provide multiple means of presentation.

**Limitations**

This study was limited by its research design. The small sample size, which was not randomly selected, rendered this study’s results as ungeneralizable to a larger population. In addition, the creation of a semistructured interview approach limited the researcher from modifying the questions during an interview.

Another limitation of the study was the interview process. The data collected during an interview can be impacted by several human factors: degree of rapport and trust built between the researcher and the participants, personal bias, and the emotional state of
both the participants and the researcher (Patton, 2015). These factors may contribute to the quality and comprehensiveness of the data collected.

Finally, the unintended bias of the researcher has to be acknowledged. Although steps were taken to mitigate this researcher’s bias, it is possible some bias could have leaked into the analysis and interpretation of the data.

**Summary**

This chapter provided an overview of the research study methodology. The research purpose and questions provided the basis for the study. The research design was outlined and included the population, sample, data collection procedures, data analysis process, and the limitation of the study. The next chapter presents the data and findings from the study. The final chapter presents the conclusions, implications, and recommendations of the study.
CHAPTER IV: RESEARCH, DATA COLLECTION, AND FINDINGS

Overview

A review of the literature demonstrated the need to identify instructional
technology practices that teachers use to facilitate critical thinking, collaboration,
communication, and creativity in their students in order to prepare them for college and
career (Ertmer & Ottenbreit-Leftwich, 2010; Ertmer et al., 2012; Fontanilla, 2015; ISTE,
2016a; Mishra & Koehler, 2006; P21, 2003; 2015; Trilling & Fadel, 2009, Wagner, 2012;
2014). Therefore, this study focused on describing the instructional technology practices
Leading Edge Certified (LEC) elementary teachers perceived can assist students’
acquisition of the 21st-century skills. In order to address this topic, the researcher
interviewed 12 LEC elementary educators in Riverside County, California. This chapter
presents the findings of the research. The chapter begins by stating the purpose and
research questions, followed by a description of the methodology, population, and
sample. The chapter concludes with a summary of the findings.

Purpose

The purpose of this phenomenological study was to describe the perceptions of
current and former Leading Edge Certified (LEC) elementary school teachers regarding
instructional technology practices that facilitate students’ development of critical
thinking, collaboration, communication, and creativity (4Cs) in one-to-one computer
classrooms in Riverside County, California.

Research Questions

This study was guided by one central question. The central question was divided
into four subquestions.
**Central Question**

What are the lived experiences of current and former Leading Edge Certified (LEC) elementary school teachers in facilitating students’ learning of critical thinking, collaboration, communication, and creativity skills through technological instructional practices in one-to-one classroom?

**Subquestions**

1. What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate critical thinking in their one-to-one classroom?

2. What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate collaboration in their one-to-one classroom?

3. What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate communication in their one-to-one classroom?

4. What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate creativity in their one-to-one classroom?

**Research Methods and Data Collection Procedures**

A qualitative, phenomenological methodology was selected for this study to describe the perceptions of current and former LEC elementary school teachers regarding instructional technology practices that facilitate students’ development of critical thinking, collaboration, communication, and creativity (4Cs) in one-to-one computer classrooms. As the study sought to capture the participants’ “lived experiences” and explore their perceptions to answer the study’s research questions, the use of in-depth,
semistructured interviews and the collection of artifacts were reasoned most appropriate (Patton, 2015, p.115). The researcher conducted 11 face-to-face interviews and one telephone interview with current and former LEC elementary school teachers in Riverside County, California: two from Banning Unified, five from Romoland School District, and five from Menifee School District.

The participants selected the date, time, and location of the interview. Eleven participants chose to conduct the interview in their classroom. One participant requested a telephone interview. The researcher contacted this participant on his/her cellular telephone and conducted the interview. All interviews were conducted during January and February 2017. All participants were provided an advance electronic copy of the interview outline, which listed the interview questions divided into three sections. In addition, each participant signed an informed consent and audio release prior to the interview. Interviews were recorded by two electronic devices and then transcribed using the Rev Application and transcription service. All participants were provided a verbatim transcription for review and editing as necessary. The data obtained through the interview transcriptions were coded, analyzed, and categorized into themes using the NVivo coding software. The codes and themes were then correlated to the study’s research questions that resulted from the findings of the study. An independent review of the codes and themes developed from the data was conducted by a colleague familiar with but not party to the study to ensure intercoder reliability.

**Population and Sample**

The population for this study consisted of 2,180 certified LEC digital educators (teachers) in California (E. Walters, personal communication, November 9, 2016). The
study’s population included those educators who taught in public unified and/or elementary districts and had been granted an LEC certification after successful completion of a digital portfolio with technology-enhanced projects demonstrating learning activities that encourage students to think critically, communicate, collaborate, and create. It excluded educators from private or charter schools. The target population for this study was elementary teachers with the Digital Learning LEC who worked in public unified or elementary school districts within Riverside County, California. At the time of this study, there were 35 Digital Learning LEC-certified elementary teachers in Riverside County, California.

The researcher used a combination of purposive sampling and convenience sampling to construct the sample for this study. The study’s sample consisted of 12 public school elementary teachers in Riverside County, California who held a Digital Educator LEC. Due to a limited target population and sample size within Riverside County, California, safeguards were utilized to ensure participants’ confidentiality and anonymity. The names and all signifying information were absent from the presentation of data and the findings. The 12 participants were identified with numeric representation (e.g., Participant/Teacher 1 [P1]; Participant/Teacher 2 [P2]; Participant/Teacher 3 [P3]; etc.).

**Presentation of the Data**

In order to answer the central research question, the researcher coded emergent themes from the data by participant and each subquestion. In addition, artifacts that correlated with teacher participants’ responses were identified by corresponding appendices. The data were organized to respond to the four research subquestions. In
addition, the data from the 12 participants were synthesized in a table to illustrate the themes with the most frequency counts and the number of participants who noted these themes as related to the study’s purpose. The data are presented by each research subquestion followed by a synthesized summary of the finding and are supported by artifacts to address the central question of the study.

**Research Subquestion 1**

The first subquestion sought to answer, “What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate critical thinking in their one-to-one classroom?” The International Society for Technology in Education ([ISTE], 2016a) standards for students and the Partnership for 21st Century Learning [(P21), 2015] described critical thinking as the ability to construct knowledge through the analysis, synthesis, and evaluation of online sources for credibility and use this information to support problem solving and self-reflection on the learning process. The 12 teachers who were interviewed identified four themes. The frequency count ranged from 40 to 102. The researcher included the most frequently recorded theme that was also noted by a minimum of 10 teachers. Table 5 illustrates the identified instructional technology practices LEC elementary school teachers perceived the most appropriate to facilitate critical thinking in their one-to-one classroom.

**Teacher gradual release of responsibility.** The *gradual release of responsibility* was the most frequently identified instructional strategy LEC elementary teachers perceived to facilitate critical thinking in their students. The gradual release of responsibility received a frequency count of 106 and was identified by all 12 teachers who were interviewed. Forty-six frequency counts within the gradual release of
responsibility involved the censorship of online content sources. Six teachers noted the need for content censorship four to five times during the interview; the remaining six teachers noted the need for content censorship two to three times. The gradual release of responsibility model of instruction requires the teacher to shift from assuming “all the responsibility for performing a task . . . to a situation in which the students assume all of the responsibility” (Duke & Pearson, 2002, p. 211).

Table 5

*Instructional Technology Practices Perceived to Facilitate Critical Thinking, in Descending Order from Most Frequent to Least Frequent*

<table>
<thead>
<tr>
<th>Instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate critical thinking in their one-to-one classroom</th>
<th>Total frequency count</th>
<th>Total number of teacher participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher gradual release of responsibility</td>
<td>106</td>
<td>12</td>
</tr>
<tr>
<td>Problem solving</td>
<td>66</td>
<td>12</td>
</tr>
<tr>
<td>Guiding questions</td>
<td>44</td>
<td>11</td>
</tr>
<tr>
<td>Student self-reflection tools</td>
<td>41</td>
<td>10</td>
</tr>
</tbody>
</table>

P11 noted the use of gradual release of responsibility to expose students to Web 2.0 tools and then eventually shift ownership of the learning to the students. P11 stated,

So that was one of my projects, was to create a Go Animate project. And so I took it a step further, and I brought it into the classroom, and I had the kids create their own Go Animate. First, I taught . . . first, I showed them . . . first, I exposed them to the project on what I worked on, and then I challenged them to create their own, after a little bit of instruction. So, they were able to be part of my project, my learning.
P6 agreed with P11’s perception that the gradual release of responsibility of Web 2.0 tools is a highly effective way to facilitate critical-thinking skills:

I hook up through Apple TV and I go into Seesaw and I say, “Okay, let’s do a lesson and you are going to help me do this lesson because you can watch it again on Seesaw if you forget what to do. This is how I would like you to create your videos and I will tell the story. I told them, “I like red velvet cupcakes. My mom gave me eight red velvet cupcakes.” And I drew them—8 red velvet cupcakes. “I love red velvet cupcakes so much I ate seven of them.” I start crossing 1, 2, 3, 4, 5, 6, 7. “How many red velvet cupcakes do I have left?” I modeled it for them, and then I saved and then I put it into our classroom feed. We already sat and learned Seesaw and learned how to do the video. They’ve had that experience already, so they now needed to go in and tell their subtraction story.

P1 and P4 discussed the importance of providing elementary students with online sites and sources to use when constructing their knowledge. Both teachers believed the Internet had so much information that it would be safer to limit or censor the sites their students could utilize. P1 stated,

It’s better to give them something, show them, “Okay, these are gonna be the sites that you’re gonna go to” and then go for it from there.

P4 concurred:

Google Classroom is used district-wide. There are other forms, but a lot of teachers have their own Google site. I think there’s a specific location that all teachers steer their students towards, and that allows us to vet ahead of time what we want our students to be referencing. (see Appendix M)
P2 also added that if classrooms, schools, or districts used Google Application for Education (GAFE), there are additional tools teachers and students can use to ensure an online source is reputable. P2 stated,

And we even have an extension that the kids put on their computers that will warn them. If you’ve got the green light you’re good. And the red light, that’s not a good source.

The gradual release of responsibility has been identified as a highly effective instructional strategy to support students’ learning of content (Duke & Pearson, 2002; Fisher, 2008).

**Problem solving.** The use of *problem solving* was the second most frequently identified instructional strategy LEC elementary teachers perceived to facilitate critical thinking in their students. Problem solving was identified 66 times by all 12 teachers as an instructional strategy to support their students’ critical-thinking skills. Five teachers mentioned problem solving between eight and 12 times during their interview, and the remaining seven teachers noted the importance of problem solving two to three times. Problem solving involves a process of defining a problem, devising a plan of action, implementing the solution plan, and then reflecting and revising (Marzano & Heflebower, 2012; Trilling & Fadel, 2009). P4 stated,

One of the projects we’ve always done in our classroom is called the planter box project. It’s a math-based problem. It’s for volume. Students have to design a net, a scale model net of a planter box, and then they actually build it. They scale it up and build it, out of Styrofoam and sticks. I found an online application and encouraged students to do . . . I didn’t know if it would be successful or not, was
it was a program online where they type in the dimensions of their three . . . the length, width, and height of the boxes, and it would develop a digital model for them. They could literally test every one of their net measurements, and kind of it would rotate three dimensionally, kind of like the graphic design for your interior design, so they could see the visual model of it here, and then take that, and because they could reference back to this visual model from all angles. I think they see things better when they can play around with it digitally and then bring it to life out here.

P12 concurred with P4 and further noticed,

I’d also have them kind of analyze afterwards, of each other. What part was very clear? What part did you have trouble understanding?

P5 has students use the problem-solving process to create video scenarios on how to deal with bullies. P5 stated,

So I had the kids act it out. We videotaped that and what that would look like because sometimes it’s too abstract for them, so if they act, make a little script and act it out like what would bullying look like or how would you say no and walk away from that. They like it, and I think it’s more meaningful to them when they do it and are learning from it. They’re directing their own behaviors.

P8 discussed using brainstorming to support the problem-solving process:

There is an application that they can make little like webs and put the information in there from what they’re learning. (see Appendix N)

Wagner (2014) asserted the critical-thinking skills needed by the future workforce include the ability to problem solve: “Work is defined by the task or problem you and
your team are trying to solve. . . . Teams have to figure out the best way to get there—the solution is not prescribed” (p. 15). Furthermore, Trilling and Fadel (2009) and Darling-Hammond (2015) contended that a problem-based learning approach enables students to learn more deeply because they are taught not only what to learn but also how to learn.

**Guided questioning.** Eleven of the 12 teachers interviewed described that in order to facilitate elementary students ‘critical-thinking skills, they used *guided questioning*. Guided questioning was mentioned 43 times during the interviews. According to the Foundation for Critical Thinking (n.d.), thinking is driven by posing the right questions, not answers, thus positioning the practice of inquiry as foundational to higher level cognition.

P10 recalled the use of guided questioning to support students with identifying and reporting the main idea on each slide of their presentation on the Revolutionary War:

I said, “Okay, do you need all of this? Or just this little piece more is what you need?” That was really me guiding them, thinking about what they needed to keep.

P11 also recalled supporting student teams with guided questioning when teams were developing a fundraising pitch to be presented to their classmates in order to raise money for a class 3D printer:

Then I check in with them, and then I say, “Well, did you think of this? Well, what about this? Well, you’ve got to figure out this.” We meet as a group. I give them suggestions, kind of point them in the right direction, and then send them back to their group.
P2 described how awareness and practice of leveled questioning has also supported students’ higher level thinking:

We are an AVID elementary; we’re very aware of Costa’s Levels of Questioning and everything. Students actually are aware of Costa’s. In literature groups, student teams practice developing different leveled questions weekly. That’s one of the things they have to do; they have to come with the level one, two, three, questions that are there.

**Student self-reflection tools.** The fourth most frequently identified instructional strategy to facilitate students’ critical-thinking skills was student *self-reflection tools*. Providing students with tools to reflect on their learning progression was noted 41 times during the interviews. Ten of the 12 teachers believed student self-reflection tools allowed students the opportunity to monitor and take ownership of their own learning. Hattie (2008, 2012) asserted that students who are provided success criteria can self-monitor their learning and then establish and adjust their learning goals. One of the student self-reflection tools utilized was rubrics. P2 stated,

Give them the rubric. Oh, it’s rubric, rubric, rubric. You should put it up in both the classroom and Google classroom (virtual classroom) so they have it and can refer back to it. (see Appendix O)

P3 concurred with P2:

I think one thing I learned was giving them a rubric ahead of time, just so they really understood. “Here’s what’s expected of you.” They had a rubric for their engineering project. They also had a rubric for their presentation so they could self-assess and see.
Another important student self-reflection tool that five of the 12 teachers employed in their one-to-one classroom was an electronic student portfolio. P4 explained,

An electronic portfolio is culminating all the student work. Students can look back, and I think that’s a kind of way for students to reflect . . . look back at everything they’ve done and have kind of a digital copy of that.

P5 agreed and added,

So they all have in their Google Drive, a second-grade portfolio. They have a screen cast of portfolios so everything that they videotape is in there. I found the kids, even my lowest kids, they said, “I notice my sentences weren’t right when I videotaped myself.” They start editing more because they’re going to video it and they know if it’s not right, it doesn’t sound right when they say it and they’re self-correcting.

The importance of teachers’ providing their students with self-reflection tools to support students’ critical-thinking skills was evident in the interviews. These tools provide students the opportunity to reflect on their learning process and build student ownership (November 2012). Furthermore, the *ISTE Standards for Students* (2016a) asserted that in order for students to be empowered learners, they need to be able to take an active role in choosing and monitoring their individual learning goals.

**Research Subquestion 2**

The second subquestion sought to answer, “What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate collaboration in their one-to-one classroom?” The *ISTE Standards for Students* and the P21 described collaboration as the ability to work in small groups, take various roles, and
work as a team toward a common goal. The 12 teachers who were interviewed identified three themes. The frequency count ranged from 27 to 51. The researcher included the most frequently recorded theme that was also noted by a minimum of 10 teachers. Table 6 illustrates the identified instructional technology practices LEC elementary school teachers perceived the most appropriate to facilitate collaboration in their one-to-one classroom.

Table 6

*Instructional Technology Practices Perceived to Facilitate Collaboration, in Descending Order From Most Frequent to Least Frequent*

<table>
<thead>
<tr>
<th>Instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate collaboration in their one-to-one classroom?</th>
<th>Total frequency count</th>
<th>Total number of teacher participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooperative groups</td>
<td>51</td>
<td>10</td>
</tr>
<tr>
<td>Peer-to-peer teaching</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Shared presentations tools</td>
<td>27</td>
<td>10</td>
</tr>
</tbody>
</table>

**Cooperative groups.** The use of *cooperative groups* was the most frequently identified instructional strategy LEC elementary teachers perceived to facilitate collaboration in their students. Cooperative groups received a frequency count of 51 and was identified by 10 of the 12 teachers who were interviewed. Collaboration can be facilitated in a classroom using cooperative learning groups that are composed of small, heterogeneous student teams who work interdependently to solve problems, while the teacher acts as a guide (Kivunja, 2014a; Plucker et al., n.d.). Teachers identified the importance of assigning roles within the cooperative groups. P1 stated,
I had them in groups and teams, and what I did, instead of just having them buddy up with their buddy, I actually went through and thought, “Okay, this one would be good as a recorder. This one would be good as the leader. This one would be good as the doer of the group”; and so I set them up strategically to make sure that when they were working together that they would collaborate a little bit more easier with each other.

P 12 agreed with P1 and added,

Often I rotate the roles; students were working in these same triads (groups) for several days, but I would switch the role of recorder, facilitator, computer monitor, etc. daily.

P5 also mentioned the importance of establishing expectations or norms:

In our class we collaborate a lot because I put them in groups a lot and we talk about expectations of that. So when we get to the technology part of collaborating (Shared Google Doc or Slides), they’re pretty used to collaborating with others and knowing that maybe your idea is not always right or you can add to it with someone else’s idea. They start saying “Oh, you can do this part and I’ll do this part” and it gets better and better. (see Appendix P)

P2 concurred with P5 and shared,

We have to know what it means to collaborate, and we make norms for collaboration. They have to understand what’s expected of them. You’d have to ask the individual groups because they come up with their own norms, but generally it’s your typical participate, be respectful, listen. It’s usually a set of things that are—Each group does their own norm creating.
P8 described the importance of the cooperative groups having a common goal or purpose:

One would be looking, Googling information. Then the other one had the share Google Slides adding pictures, and they were able to put it all together on their shared Google Slides for presentations.

P11 added the importance of students’ working in cooperative groups in both the real and virtual world:

As far as collaboration, well, they’re working together, so they’re collaborating face-to-face, and also one-to-one on the Chromebooks.

Cooperative groups have been identified as a highly effective instructional strategy to support students’ learning of content and working toward a common goal (Kivunja, 2014a; Plucker et al., n.d.). Furthermore, according to Crockett et al. (2011), students must also be able to work in cooperative groups “in both the physical and virtual spaces, with real and virtual partners globally” (p. 19).

**Peer-to-peer teaching.** The use of *peer-to-peer teaching* was the second most frequently identified instructional strategy LEC elementary teachers perceived to facilitate collaboration in their students. Peer-to-peer teaching received a frequency count of 30 and was identified by 10 of the 12 teachers who were interviewed. Peer teaching involves one or more students’ teaching other students a particular content or skill and builds on the belief that this type of collaboration solidifies the learning (Whitman & Fife, 1988). Furthermore, Boud (1988) explained, peer teaching should involve the sharing of knowledge, ideas, and experience between students while moving beyond independent to interdependent or mutual learning.
P1 explained how peer-to-peer teaching supports students’ shared understanding of various technology tools and applications:

They really got into it. The nice things with the technology is they were able to use those things, learn the technology, and then while they were doing it, kind of teaching other people at the same time. I really kind of stepped back and said to myself, “It’s okay for them to teach other,” because they’re probably going to learn more than me modeling to them.

P9 concurred with P1:

I see a lot of collaborations. . . . We have a new program, WeVideo; it’s an online video editing program and when someone finds something new, they’ll share with their team,” Oh! Did you know that you could this?”

P4 recalled a time students used peer-to-peer teaching to collaboratively analyze online sources:

Each of them had to go find four resources on each of the types of natural disasters, but they had to do that individually. Then, they came back as a group and they cross-referenced the sites, the sources they found. In that process, they were able to see, “Oh, I found that [source] too,” or “I found another [source] that says the exact same thing.” I think that was a good way of showing them that if you all go out and look at different places and bring them back together, you can sort through it and find what’s relevant and what’s not relevant. That was a cool tool for collaboration, I thought.

P3 described a time peer-to-peer teaching provided an opportunity for students to see issues from multiple perspectives:
Collaborating with others, one thing that we did last year, I use Skype for education. I did Mystery Skypes, from different places in the country, and then also some in other countries. It was where the mystery was, we would be broadcasting the Skype and then have to ask questions about those kids, and then try to figure out where they were located.

P5 concurred with P3 and added,

I really like Common Core, just the aspect of them working and collaborating in collaborative groups because sometimes I don’t know everything. They help each other, or I can teach a math concept 10 times and they won’t get it and then I’ll say, “Okay Stafford, show us your way to do it” and then Stafford will show his way and then I’ll say, “Okay Emily come up and show your way”; and the kids go, “Oh I get it that way” and you’re just like, “Oh!”

Additionally, P12 expressed how students feel empowered as a learner when they are able to be an expert:

When we were working on the Chromebooks, I had a couple of experts that just came over for that first couple minutes to kind of monitor. I tell the [experts], I said, “Don’t do it for them at first. Just kind of help lead them through.”

P6 agreed with P12:

If someone is stuck on an iPad or stuck on a Chromebook, I’ll say, “I need a technology expert at Table 4.” Then just [one of the technology experts] will pop up, “Oh okay.” They love that title.

Shared presentation tools. Ten teachers reported the use of shared presentation tools 27 times. The ability to share information with a partner or a cooperative group
instantaneously from any location nurtures a collaborative environment (November, 2012; Trilling & Fadel, 2009). P2 shared how students can work together to then share their learning with the rest of their class:

They would collaborate on a Google Doc or the Google Slides about the animal habitat they were researching. My first graders would create a Google Slide with like a picture and you know, a couple sentences. (see Appendix Q)

P3 recalled a time when a shared presentation tool, Google Slides, supported students to collaborate on a project. The students took on the role of a construction team. The teams were tasked with creating an earthquake-resistant structure. P3 stated,

The culminating tasks for that was, they were presenting a shared Google Slide show to a panel and that was their parents.

P5 agreed with P3 and added that shared presentation tools also provide students the opportunity to work with other classrooms:

We collaborate and everybody has to find a text feature. We take pictures of it and then we make one big Google slideshow and they are in charge of that number [slide]. So I’ve pushed [shared the Google Slide presentation] and we all worked on our slide. At the end the finished project that we share with all the other second grade classrooms.

P4 explained how students collaborate with several share presentation tools to create a school-wide news feed and letter:

First, they would have to take that [video footage] and turn it into script, and then they would have to become news anchors. We have a film studio, and they would have to go in and record all of the script, go back and cut and piece it together,
take all the footage they found and cut and edit that together . . . like the actual news broadcasting. Then, there was a whole separate group of the class that would take all the material and turn it into a digital newsletter, and we published it on a Google site.

The *ISTE Standards for Students* (2016a) stated that in order for students to be global collaborators, they need various opportunities to work effectively with diverse groups not only to enhance their mutual understanding but also to see issues from multiple perspectives. The importance of establishing cooperative groups, providing opportunities for students to teach one another, and allowing them to present their shared learning to others are instructional strategies perceived to facilitate collaboration in elementary students was evident in the interviews.

**Research Subquestion 3**

The third subquestion sought to answer, “What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate communication in their one-to-one classroom?” According to P21 (2015), students need to be able to “articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts” for several purposes (p. 4), through multimedia and technology to a diverse audience (Kivunja, 2014b; P21, 2015). The 10 teachers who were interviewed identified a total of three themes. The frequency count ranged from 40 to 55. The researcher included the most frequently recorded theme that was also noted by a minimum of 10 teachers. Table 7 illustrates the identified instructional technology practices LEC elementary school teachers perceived the most appropriate to facilitate communication in their one-to-one classroom.
Table 7

*Instructional Technology Practices Perceived to Facilitate Communication, in Descending Order From Most Frequent to Least Frequent*

<table>
<thead>
<tr>
<th>Instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate communication in their one-to-one classroom?</th>
<th>Total frequency count</th>
<th>Total number of teacher participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear teacher expectations</td>
<td>55</td>
<td>12</td>
</tr>
<tr>
<td>Student self-select communication tool</td>
<td>43</td>
<td>11</td>
</tr>
<tr>
<td>Class discussion</td>
<td>40</td>
<td>12</td>
</tr>
</tbody>
</table>

**Clear teacher expectations.** The use of *clear teacher expectations* was the most frequently identified instructional strategy LEC elementary teachers perceived to facilitate communication in their students. Clear teacher expectations received a frequency count of 55 and were identified by all 12 teachers who were interviewed. Effective, positive, and safe communication can be promoted in a classroom with clear expectations or objectives (Marzano, Pickering, & Pollock, 2001). All 12 teachers identified the importance of teaching students about digital citizenship. P1 explained,

> We had gone over digital citizenship and digital technology and things like that and how to behave with the actual technology in front of them.

P10 and P2 agreed with P1. P10 added that the school district provides Common Sense Media digital citizenship lessons to be taught monthly:

> There’s lessons in every unit about cyber-bullying, appropriate websites . . . basically how you present yourself online. (see Appendix R)
Additionally, P11 remarked that clear expectations also need clear consequences:

Any directive that’s given comes from me, as far as what they’re allowed to do. If they’re not doing what they’re supposed to be, then they lose their computer use. And there’s 29 other police in here, so trust me. If somebody’s found somewhere they’re not supposed to, I hear about it. I use the “if you can’t do what you’re doing online safely or effectively, then you’re not going to use the computer.”

Teachers explained another component of digital citizenship is for students to be able to cultivate and monitor their online identity. P12 shared,

We do a lot of the training and our students know not to give out their passwords or personal information.

P4 elaborated on the importance of students’ managing their digital footprint:

I explain why we have the online behavior expectation and tell them, “Here’s your digital footprint, and everything you do online can be . . . is recorded, and can be searched, and can be printed, and can be copied and shared.”

P5 explained that clear expectations for communication, in class or online, is not just about behavior but also about the students’ clearly conveying their thoughts and ideas:

I showed them all these steps, and I brought them to the carpet and on my big screen I showed them my expectations: “Okay go do this step” and they did it. I’m real picky. I’ll tell them, “If you want to send it to Mr. Mobley,” who is our principal, “It has to be perfect. Your margins have to be perfect. Everything has to line up. Your words have to be perfect. You have to have the capitals and periods. Everything has to be perfect and centered.”
**Student self-selected communication tool.** Student self-selection of communication tool was identified with a frequency of 43 during the interview process. Eleven of the 12 teachers referenced students’ ability to self-select their communication tool for learning to be a powerful instructional strategy. Student choice increases student agency, the level of autonomy a student experiences in an educational situation, which supports students to become empowered learners (ISTE, 2016a). P3 noted that after students were taught several different Web 2.0 tools and applications, they chose the tool that would best communicate their learning of math content:

They would do math problems and then have to explain the steps of the math problems, so that was another great way for them communicating their learning. They would select tools, such as Educreations or Screencast. Screencast allowed them to record themselves doing something and kind of talk over it, and then with Educreations they could draw on the screen.

P2 further explained,

Instead of me saying, “You’re going to use VoiceThread for this [assignment/presentation].” It’s basically giving them the power of choice. They might decide, “You know what? I’m going to use PowToons for this [assignment] and I can show the same thing.”

P1 agreed and added,

Then, it got to the point where it’s like, okay, you choose. You can do a document, or you can do Voki, or you can do a slide, or you can do another Web 2.0 tool that we have.
P10 also explained the power of giving students the choice between a high- or low-tech tool:

    They had a choice. They could either do it on a poster or they could do it digitally.

Providing students with the choice to express their learning using a variety tools not only allows student to become empowered learners, but it also grants them the permission to become creative communicators (ISTE, 2016a).

Class discussions. All 12 teachers interviewed noted the use of class discussions 40 times. Class discussions is an instructional strategy employed to create opportunities for students to practice and sharpen various skills (Davis, 1993). P12 described discussions with students concerning communicating their learning to different audiences. P12 stated,

    Like font, is the font readable. . . . You have to think about all those things a lot. A lot to go into it [shared presentations to peers]. I think those are all just discussions and you continually bringing them up.

P2 added discussions could be done via e-mail:

    You know they e-mail it to me and I will send a reply, “What is your focus and what was your team trying to accomplish here?”

P3 explained that class discussions may focus on how to actually carry on a conversation, whether it is face to face or virtually:

    We did a lot with a kid blog, and then on their Google Classroom, where they would have to go in and answer questions and then other students would have to respond to those, so kind of teaching them what’s appropriate in that sense, where
you don’t just say, “Yeah,” or “Me too,” that kind of thing. Acknowledging other people like, “I like how you said this,” so teaching them to listen to other people’s idea.

P8 agreed with P3 and elaborated,

When students respond, I have sentence frames up there. Like in math, “I learned how to . . . ” They can use that to learn how to speak, to learn how to respond [in class or online].

Trilling and Fadel (2009) stated that students will be expected to communicate clearly and concisely through face-to-face interaction, either physically or virtually, using a variety of tools to interpret, create, and convey meaning and products in an ever-increasing digital world. The 12 teachers interviewed described clear expectations for communication, providing students with choice in their communication tool, and classroom discussions as instructional strategies to facilitate communication skills within their students.

**Research Subquestion 4**

The fourth subquestion sought to answer, “What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate creativity in their one-to-one classroom?” In order to cultivate creativity, students must explore, question, and take risks in both a digital or nondigital learning environment (Crockett et al., 2011; Kivunja, 2014b; Trilling & Fadel, 2009; Zhao, 2015). The 12 teachers who were interviewed identified a total of two themes. The frequency count ranged from 18 to 38. The researchers included the most frequently recorded theme that was also noted by a minimum of 10 teachers. Table 8 illustrates the identified
instructional technology practices LEC elementary school teachers perceived the most appropriate to facilitate creativity in their one-to-one classroom.

Table 8

Instructional Technology Practices Perceived to Facilitate Creativity, in Descending Order From Most Frequent to Least Frequent

<table>
<thead>
<tr>
<th>Instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate creativity in their one-to-one classroom?</th>
<th>Total frequency count</th>
<th>Total number of teacher participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student self-expression</td>
<td>38</td>
<td>10</td>
</tr>
<tr>
<td>Discovery/play</td>
<td>19</td>
<td>10</td>
</tr>
</tbody>
</table>

**Student self-expression.** The use of *student self-expression* was the most frequently identified instructional strategy LEC elementary teachers perceived to facilitate creativity in their students. Student self-expression received a frequency count of 38 and was identified by 10 of the 12 teachers who were interviewed. Student self-expression can facilitate creativity by allowing students to use their imagination in their thinking and communicating with others (Robinson, 2015). P2 stated,

We finished the book *Esperanza Rising*, and we did AVID One-Pager, a single-page response that is a representation of your understanding of a piece of text. Anyways, so when I think of a main character, I think of Esperanza, right? And I think of Miguel. I don’t think of Papa as a main character. But when you start reading some of their things, when they realize that Papa, the spirit of him and how it’s interwoven in the whole setting, in all the fruit, etc. And you realize that
Papa is a main character. He’s just not a main character how I think of a main character. So at first, if I had given them an A-B-C-D test, and they chose Papa, it would have been, “That is not a main character” [incorrect]. But when you see something like this where they’ve been able to express their thinking, you’re like, “Oh, wow. I can see why you’re right. Papa is a main character, even though I hadn’t viewed him like that.”

P6 agreed with P2 that when given the opportunity, students will express their thinking in different ways. P2 had modeled for the class how to create a subtraction problem on SeeSaw, a Web 2.0 tool that allows student to capture their audio and visual learning. P2 recalled,

Yeah. An example would be Gabriel. He didn’t talk about food. He drew a picture of a house. At first I thought, “Okay, he didn’t get what he was supposed to. . . he doesn’t understand.” But I kept watching. He drew the house. He drew, “This is my mom. This is me. This is my dad.” Then he said, “There are 3 of us, and then my mom went to the store and now there are 2 of us.” He didn’t write the number sentence, but he did what he was supposed to do.

P4 further explained,

When choosing, whether it was a Canva or a PowToons or just a general Google Slide, you’re letting them choose what option is best for them. If they’re working in a group, there may be a good mixture of creativity amongst that group, and they can feed off of one another. Choice is huge for kids. If they don’t feel like they have a decision, they don’t have some say in the decision-making process, then I think that kind of stunts them, and it smothers their creativity.
**Discovery/play.** Ten of the 12 teachers interviewed shared that to foster creativity in their students, they need to provide opportunities for students to play and discover. Student *discovery/play* received a frequency count of 19 and was identified by 10 of the 12 teachers who were interviewed. Human beings are curious by nature and enjoy exploring, experimenting, and envisioning new and different possibilities (Robinson, 2015; Wagner, 2012). When the students first received their Chromebooks, P1 stated,

> Discovery was a good strategy that I used. Just to go out there and find. I wanted to sort of have them [students] jump in, feet first, get going on it, and get that insightfulness, get that eagerness, the ooh, this is something new that we have, because we were the first classroom in the entire school to have computers one-to-one, so this was something special. Doing that really got the kids going.

P11 concurred with P1 and elaborated,

> I didn’t teach any of them how to do PowerPoint. They let them figure it out on their own.

P2 noted,

> Some kids would go on and they would teach themselves YouTube things, to use the microscopes, or whatever they were doing. So they were using YouTube.

Other teachers explained that students are so curious and creative, they discovered how to work around district firewalls. P4 recalled,

> The student devices are very restricted, but a lot of students over the course of the past 3 years have found ways around, or identified sites or little nooks and crannies that they could get to.
P2 agreed:

These little guys are so crafty. They have now recently found a way to use a browser that does not show up on history.

P5 observed,

You show the kid a little of technology, they just go and run with it. You don’t have to know everything about technology; the kids can figure it out; you just have to be excited and get them going.

Ten of the 12 teachers interviewed described student self-expression and discovery/play as instructional strategies to facilitate creativity in their elementary students. The *ISTE Standards for Students* also stated the need for students to be able to create original works to be a creative communicator (ISTE, 2016a).

**Summary**

Chapter IV presented the data and findings of this qualitative inquiry. The study sought to describe the perceptions of current and/or former LEC elementary school teachers regarding instructional technology practices that facilitate students’ development of critical thinking, collaboration, communication, and creativity (4Cs) in one-to-one computer classrooms in Riverside County, California. The study’s population included those educators who taught in public unified and/or elementary districts and had been granted a LEC certification after successful completion of a digital portfolio with technology-enhanced projects demonstrating learning activities that encourage students to think critically, communicate, collaborate, and create. It excluded educators from private or charter schools. The target population for this study was elementary teachers with the Digital Learning LEC who worked in public unified or elementary school districts within
Riverside County, California. A total of 12 current or former elementary LEC teachers participated in this study.

The central research question that guided this study was, “What are the lived experiences of current and former Leading Edge Certified (LEC) elementary school teachers in facilitating students’ learning of critical thinking, collaboration, communication, and creativity skills through technological instructional practices in one-to-one classroom?” Four subquestions were used to examine the central question: (a) What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate critical thinking in their one-to-one classroom?; (b) What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate collaboration in their one-to-one classroom?; (c) What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate communication in their one-to-one classroom?; and (d) What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate creativity in their one-to-one classroom?

An interview protocol was established with background questions and 10 primary interview questions that addressed each one of the subquestions of the study. Eleven of the 12 participants engaged in in-depth, face-to-face interviews. All interviews were recorded using two digital devices and the Rev application. Interviews were transcribed using the Rev Transcription service; all participants were provided a copy of the transcription. The data obtained through the interview transcriptions were coded, analyzed, and categorized into themes, using the NVivo coding software and then correlated to the study’s research questions, which resulted in the findings of this study.
An independent review of the data was conducted by a colleague familiar with, but not involved in the study, to ensure intercoder reliability.

Findings from this study related to the instructional technology practices LEC elementary school teachers perceived the most appropriate to facilitate critical thinking in their one-to-one classroom and yielded the most frequencies, included the following:

- Teacher gradual release of responsibility
- Problem solving
- Guiding questions
- Student self-reflection tools

The most frequently identified instructional technology practices LEC elementary school teachers perceived the most appropriate to facilitate collaboration in their one-to-one classroom included the following:

- Cooperative groups
- Peer-to-peer teaching
- Shared presentations tools

The most frequently identified instructional technology practices LEC elementary school teachers perceived the most appropriate to facilitate communication in their one-to-one classroom included the following:

- Clear teacher expectations
- Student self-select communication tool
- Class discussion
The most frequently identified instructional technology practices LEC elementary school teachers perceived the most appropriate to facilitate creativity in their one-to-one classroom included the following:

- Student self-expression
- Discovery/play

Chapter V of this study presents conclusions based on these findings. Chapter V also offers implications for future action and recommendations for future research.
CHAPTER V: FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

Chapter V provides a recounting of the purpose of this study, the research questions, the methodology, and the population and sample. The chapter then presents a summary of the major findings. Chapter V also includes an account of the unexpected findings. The researcher then provides conclusions based on the research findings. Finally, the researcher offers implications for action and recommendations for further research based on the findings of the study.

Purpose Statement

The purpose of this phenomenological study was to describe the perceptions of current and former Leading Edge Certified (LEC) elementary school teachers regarding instructional technology practices that facilitate students’ development of critical thinking, collaboration, communication, and creativity (4Cs) in one-to-one computer classrooms in Riverside County, California.

Research Questions

This study was guided by one central question. The central question was divided into four subquestions.

Central Question

What are the lived experiences of current and former Leading Edge Certified (LEC) elementary school teachers in facilitating students’ learning of critical thinking, collaboration, communication, and creativity skills through technological instructional practices in one-to-one classroom?
Subquestions

1. What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate critical thinking in their one-to-one classroom?

2. What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate collaboration in their one-to-one classroom?

3. What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate communication in their one-to-one classroom?

4. What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate creativity in their one-to-one classroom?

Research Methods

A qualitative, phenomenological methodology was selected for this study to describe the perceptions of current and former Leading Edge Certified (LEC) elementary school teachers regarding instructional technology practices that facilitate students’ development of critical thinking, collaboration, communication, and creativity (4Cs) in one-to-one computer classrooms. As the study sought to capture the participants’ “lived experiences” and explore their perceptions to answer the study’s research questions, the use of in-depth, semistructured interviews and the collection of artifacts were reasoned most appropriate (Patton, 2015, p.115). Collecting participants’ detailed accounts and stories was crucial to describing and understanding the lived experiences of current and former Leading Edge Certified (LEC) elementary school teachers in this qualitative study.
Population and Sample

The population for this study consisted of 2,180 certified LEC digital educators (teachers) in California (E. Walters, personal communication, November 9, 2016). The study’s population included those educators who taught in public unified and/or elementary districts and had been granted a LEC certification after successful completion of a digital portfolio with technology-enhanced projects demonstrating learning activities that encourage students to think critically, communicate, collaborate, and create. It excluded educators from private or charter schools. The target population for this study was elementary teachers with the Digital Learning LEC who worked in public unified or elementary school districts within Riverside County, California. At the time of this study, there were 35 Digital Learning LEC-certified elementary teachers in Riverside County, California. A total of 12 current or former elementary LEC teachers participated in this study.

Major Findings

The major findings of this qualitative study are organized and presented by research subquestion.

Research Subquestion 1

Research Subquestion 1 inquired: What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate critical thinking in their one-to-one classroom? The major findings for this subquestion yielded four instructional strategies LEC elementary school teachers perceived the most appropriate to facilitate critical-thinking skills in their students.
The most frequently identified instructional strategy to support critical thinking in the classroom was the teacher’s gradual release of responsibility of the learning, with a frequency count of 106. All 12 teachers believed the gradual release of responsibility was vital to facilitating critical-thinking skills in their students because the gradual shift in the ownership of learning from teacher to student resulted in an increase in student autonomy. However, teachers also remarked that when it came to vetting online sources, teachers tended to censor the sources. The review of literature indicated that teachers’ pedagogical belief and content and technology knowledge aligned to teachers’ approach to teaching and learning (Koehler & Mishra, 2009). Simply put, a teacher will gradually shift responsibility of the learning to students based on how the teacher feels students learn best. Moreover, teacher participants described how the gradual release of responsibility was often used simultaneously with problem-solving instructional strategies to facilitate students’ critical-thinking skills. The use of problem-solving strategies was reported by all 12 teacher participants 66 times as an instructional strategy to support their students’ critical-thinking skills. Problem solving involves students’ using a process to solve problems and was identified in five of the seven International Society for Technology in Education (ISTE) Standards for Students (2016a).

Additionally, in the review of literature, educational, political, and business leaders deemed students’ ability to think critically and problem solve a high priority for future success in life (Friedman & Mandelbaum, 2011; Kline & Williams, 2007; Lotto & Barrington, 2006; Trilling & Fadel, 2009; Wagner, 2012). Teacher participants described an additional two instructional strategies that they perceived to assist in teaching critical-thinking skills. Participants felt it was important to use guiding questions to support
students to think critically. Teacher participants believed through questioning, they lead their students to reflect on their own work and actions. Finally, elementary LEC teachers identified student self-reflection tools as an important instructional strategy to promote students’ critical-thinking skills. Teachers described the use of rubrics and electronic student portfolios to encourage students to reflect and monitor their own learning. The review of literature and the *ISTE Standards for Students* indicated the significance of students’ ability to self-reflect on their learning process to improve continually so in the future they are prepared to learn in a fluid and ever-evolving future global workplace (ISTE, 2016a; P21, 2015; Wagner, 2014).

**Research Subquestion 2**

Research Subquestion 2 inquired: *What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate collaboration in their one-to-one classroom?* The major findings for this subquestion produced three instructional strategies LEC elementary school teachers perceived the most appropriate to facilitate collaboration skills in their students.

The most frequent instructional practice used to support collaboration among elementary students was cooperative groups. Teacher participants expressed cooperative groups, working toward a common goal, either face-to-face or virtually, were important to nurturing collaboration in their classrooms with a frequency count of 51 and was identified by 10 of the 12 teachers who were interviewed. Teacher participants described the importance of establishing team roles, responsibilities, and behavior norms to work toward a common goal. In addition, teacher participants expressed how the use of electronic devices facilitated collaboration. The use of cooperative groups to facilitate
collaboration not only correlated to the ISTE Global Collaborator standard for students, but it also aligned with the review of literature in that students must be prepared to work in face-to-face and/or virtual teams in a globally connected workforce (Friedman, 2007; ISTE, 2016a; November 2012; Prensky, 2001a, 2001b; Trilling & Fadel, 2009; Wagner, 2014). Peer-to-peer teaching was the next frequent instructional strategy with a frequency count of 30 and noted by 10 of the 12 teacher participants. Teacher participants described how technology facilitated the peer-to-peer teaching in that students would work collaboratively with peers to learn new Web 2.0 tools and/or learn different perspectives from others through expressing their work using Web 2.0 tools. Related to cooperative groups and peer-to-peer teaching, teacher participants felt shared presentations tools were another instructional strategy to facilitate collaboration among elementary students. Teacher participants explained the shared presentation tools provided students the opportunity to share with a partner or groups, but the presentation tools could also be used to collaborate with another classroom or school. In the review of the literature, the ISTE Standards for Students (ISTE, 2016a) stated that in order for students to be global collaborators, they require numerous opportunities to interact and work with diverse teams in order to enrich their learning and lives.

Research Subquestion 3

Research Subquestion 3 inquired: What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate communication in their one-to-one classroom? The major findings for this subquestion generated three instructional strategies LEC elementary school teachers perceived the most appropriate to facilitate communication skills in their students. The most frequent
communication instructional strategy was clear teacher expectations, reported by all 12 teacher participants with a frequency count of 55. Teacher participants expressed the importance of students’ understanding the appropriate and safe ways to communicate in both face-to-face and virtual environments. Teacher participants felt students needed clear expectations, especially while interacting online. Teachers remarked that their districts have adopted the use of Common Sense Media digital citizenship lessons, an open educational resource. The importance of appropriate online behavior to facilitate students’ communication skills aligned with the literature; the Digital Citizen ISTE Standard for Students indicated students’ responsibility to act in safe ways in an interconnected digital environment (ISTE, 2016a). Eleven of the 12 teacher participants perceived student self-selection of communication tool(s) to be an important instructional strategy as they felt it provided students with choices that increased students’ level of autonomy. The literature also outlined that students must take ownership of their learning and be able to communicate their thoughts and ideas creatively to a diverse interconnected world community (ISTE, 2016a; November 2012; Wagner, 2014). Teacher participants explained that in order to set clear teacher expectations and for students to select appropriate communication tools, class discussion must occur so students can practice their communication skills such as students’ understanding of audience, multiple platforms and tools for communication, active listening, and responding in complete sentences.

Research Subquestion 4

Research Subquestion 4 inquired: What are the instructional technology practices LEC elementary school teachers perceive the most appropriate to facilitate creativity in
their one-to-one classroom? The major findings for this subquestion yielded two instructional strategies LEC elementary school teachers perceived the most appropriate to facilitate creativity skills in their students. Ten of the 12 teacher participants thought students’ self-expression was the most important instructional strategy to support student creativity. Teacher participants were surprised at how providing students’ the time for self-expression and students’ illustrating their understanding from different perspectives in a variety of formats oftentimes caused teachers to reflect on their own perspective. The instructional strategy of student self-expression correlated closely with discovery/play. Teacher participants described how students were not afraid to fail and were eager to learn when they were discovering new technology or Web 2.0 tools. The literature expanded on the importance of play and taking risks to produce innovative designers of new ideas and products for the future (ISTE, 2016a; Robinson, 2015; Trilling & Fadel, 2009; Wagner, 2012).

**Unexpected Findings**

Two unexpected findings emerged from the data collection in this study. First, in a quantitative study, reviewed in the literature, veteran teachers tended to score themselves low in technology knowledge, resulting in lower TPACK scores (Fontanilla, 2015). However, in this study, all teachers had taught over 4 years, most taught more than 10 years and had one-to-one devices in their classrooms for less than 3 years; yet all teachers used and explored integrating technology into their instructional practices. The commonalities among the teachers in the study were that they taught elementary and had a Digital Educator LEC. This finding indicated a possible future qualitative comparative study to determine the effectiveness of the Digital Educator LEC in relation to teachers’
confidence/self-efficacy to integrate technology into their instructional practices, with a focus on the 4Cs.

A second unexpected finding also emerged concerning the Digital Educator LEC. In the literature, it was noted that in order to successfully complete and receive certification, teachers must submit an electronic portfolio. Throughout the interviews, the majority of teachers mentioned having students collect digital artifacts of their own work. Many stated the digital portfolio provided students the opportunity to monitor and reflect on their own learning, which is a highly valued skill that was noted in the literature (ISTE, 2016a; P21, 2015; Trilling & Fadel, 2009; Wagner, 2014). This finding indicated a possible future qualitative phenomenological study to hear students’ stories on the effectiveness of using electronic digital portfolios as a monitoring and self-reflection tool.

Conclusions

Based on the findings of the data collected in this study and supported by the review of literature, several conclusions were developed. The review of literature supported this study in identifying the 21st-century skills students needed to be successful in a digital, interconnected global society and affirming that teachers play a vital role in preparing students for college and career. In order to support students to be future ready, the literature explained the need for teachers to shift their teaching to be more student centered, where teachers become a facilitator of students’ learning rather than a keeper of the knowledge (Kivunja, 2014a, 2014b; November, 2012; Trilling & Fadel, 2009). Moreover, the literature noted the need for teachers to understand that their students are digital natives who want their schools to be communities where they can work collaboratively on purposeful, real-world projects; use digital tools to find and verify
information from multiple sources; and search for meaning through discussions by sharing their understanding of information early and often (Prensky, 2007). The review of the literature and this study concluded that the instructional technology practices teachers use to facilitate critical thinking, collaboration, communication, and creativity in their one-to-one classroom can lead to student preparedness for college and career. The conclusions emphasized the need to deepen teachers’ understanding of critical thinking, collaboration, communication, and creativity and their skills to integrate technology.

Four conclusions were derived from the major findings based on the lived experiences of current and former LEC elementary school teachers in facilitating students’ learning of critical thinking, collaboration, communication, and creativity skills through technological instructional practices in one-to-one classrooms. These conclusions were further supported by the review of literature in Chapter II.

**Conclusion 1**

*The technological instructional practices to facilitate critical-thinking skills in elementary students were generally at the surface level of cognition.* The data collected from the individual interviews demonstrated that although LEC elementary teachers employ specific instructional strategies to develop critical-thinking skills in their students, critical thinking remained at the lower levels of cognition, especially when it came to the evaluation of online sources. The instructional strategies most utilized by the LEC elementary teachers were the gradual release of responsibility of the learning, using a process to solve problems, guided questioning, and student self-reflections tools. The instructional strategies used are evident in the literature, particularly in the *ISTE Standards for Students* (ISTE, 2016a); however, the data revealed the majority of
Conclusion 2

*Teachers who utilized face-to-face and virtual cooperative groups and provided students opportunities to peer-teach and collectively present their learning via Web 2.0 tools in their one-to-one classroom are more likely to increase collaboration among elementary students at the local level.* The literature is clear that a highly effective team establishes roles, responsibilities, and norms for behavior; works interdependently toward a common goal; and reflects on their team’s dynamics and progress toward the common goal (Frey et al., 2009; ISTE, 2016a; Trilling & Fadel, 2009). Teachers expressed that not only did having a structured system of collaboration in place support students, but also the integration of technology naturally fostered students’ ability to collaborate via Web 2.0 tools, such as shared research, documents, slide presentations, and so forth. Although the majority of teachers had their students collaborating within their own classroom, the literature stated that for students to be productive global citizens, they need to be able to interact in a global arena with diverse teams (ISTE, 2016a; Trilling & Fadel, 2009; Wagner, 2014). In addition, effective collaboration included cooperative groups or teams to reflect on the health of the team’s work and relationship (Frey et al., 2009; ISTE, 2016a).

Conclusion 3

*Based on the lived experiences of LEC elementary teachers, the adoption and use of an open education online resource from Common Sense Media supported teachers, sites, and districts in establishing clear face-to-face and online citizenship and behavior
expectations for students, thus facilitating positive communication. Teachers indicated that since using the digital citizenship modules from Common Sense Media, the incident of negative behaviors, such as cyber-bullying or inappropriate images or language has decreased. Teachers felt the digital citizenship modules were their guide to establish clear expectations for communication whether it was in the traditional or virtual learning environment. The idea of students’ being digital citizens was supported by the literature, in that the *ISTE Standards for Students* dedicated an entire standard to digital citizenship (2016a). Moreover, the literature showed the world has become more interconnected and flat, where students can connect to anyone 24 hours a day; therefore, it is vital to students’ future success to be safe and responsible in both the real and virtual worlds, including maintaining privacy and self-image (Friedman, 2007; ISTE, 2016; November 2012; Wagner, 2014).

**Conclusion 4**

*Teachers who provided their student’s a choice in how they expressed their learning and opportunities to discover/play with technology are more likely to have elementary students who are more creative and open to new ideas, while being less averse to taking risks and failure.* A major finding that emerged from this study was that in order to support students’ creativity, it was essential to provide students multiple opportunities to express themselves in a variety of platforms and most importantly for the teacher to step back and be open to new interpretations of the learning provided by the students. Moreover, students’ ability to self-express their learning and justify their reasoning led teachers to begin to understand there may no longer be one right answer but rather multiple perspectives and the correctness of the answers are based on the reasoning
of the learners. The ability to be creative and express oneself in various venues and platforms was supported by the literature, especially *ISTE Standards for Students*: Creative Communicator and Innovator Designer (ISTE, 2016a).

**Implications for Action**

Exploration of the lived experiences of LEC elementary teachers and an extensive review of the literature revealed major findings for the development of new and experienced teachers as well as the refinement of technological instructional practices. Additionally, these important findings contribute to the literature on effective technological instructional practices in education. Based on this inquiry, four implications for action are directly correlated with the conclusions drawn from the major findings and are as follows:

1. Through the shared stories of the elementary LEC teachers, it was determined the technological instructional practices to facilitate critical-thinking skills in elementary students were generally at the surface level of cognition. Since the state, district leadership, site administration, and teachers are responsible to prepare students to be future ready, the following are calls to action:
   a) Teacher and administration preparation programs need to include course/modules on the *ISTE Standards for Students*, teachers, and administrators and defining the 4Cs while providing practice in integrated technology and the 4Cs in their lesson plans. Administrators need to understand this information in order to support the teaching and learning of the 4Cs along with technology.
   b) Ongoing professional development, whether it is at the county, district, or site level, must include an understanding of the ISTE standards, Web Literacy, the
Engineering Design Process for problem solving, and the art of facilitation through open-ended questioning.

2. A major finding in this study revealed teachers who utilized cooperative groups and provided students opportunities to peer-teach in their one-to-one classroom described more collaboration among elementary students at the local level. In order to provide students more opportunities to interact and collaborate with diverse teams, the following needs to occur:

a) Ongoing professional development, whether it is at the county, district, or site level, must include an understanding of Cooperative Group work, including information on team and self-reflection on teams’ work and social dynamics.

b) District adoption and training on a common collaboration rubric that is aligned vertically and based on research and the *ISTE Standards for Students*.

c) District and site administration model, at leadership and staff meetings, the characteristics of highly effective teams: establishment of roles, responsibilities, norms for behavior, working interdependently toward a common goal, and reflecting on their team’s dynamics and progress toward the common goal in both face-to-face and virtual environments. Then expect grade level/department teams to incorporate these characteristics into their meetings.

d) Leadership must also model the use of Personal Learning Networks to illustrate online collaboration with individuals and teams from diverse backgrounds.

3. Through the shared stories of the elementary LEC teachers, it was revealed that the adoption and use of an open education online resource from Common Sense Media supported teachers, sites, and districts in establishing clear face-to-face and online
citizenship and behavior expectations for students, thus facilitating positive communication. Since district leadership, site administration, teachers, staff, parents, and students are responsible in preparing students to act and communicate in a safe, positive manner for a variety of purposes, audiences, and platforms, the following are calls to action:

a) School boards and district leadership must adopt or create a series of lessons aligned to the ISTE standards that address and outline clear expectations of digital citizenship. This will not only support alignment to the ISTE standards, which are based on research and feedback from educational and business leaders, but it will also provide all stakeholders with a common language and set of expectations about communication as a digital citizen.

b) Digital citizenship lessons/modules must be embedded into the established scope and sequence of the history/social science curriculum.

c) Professional development opportunities for site principals, teachers, and staff must be developed and implemented to ensure alignment of language and expectations and to increase these stakeholders’ confidence in understanding digital citizenship.

d) District leadership, principals, and teachers incorporate the digital citizens’ expectations into their behavior management policies, handbooks, and syllabi.

e) Provide digital citizenship nights at school sites to educate and inform parents of the expectations of being a digital citizen.

f) Site principal and teachers model the characteristics of a digital citizen in their face-to-face and virtual interactions with one another and other stakeholders.
4. A major finding of this study was that students given the opportunity for self-expression and discover/play with technology were more likely to be creative and open to new ideas while being less averse to taking risks and handling failure. In order to provide students more opportunities to be creative, the following needs to occur:

a) Board of education, district leadership, site principals, teachers and all other stakeholders need to embrace and model failing forward.

b) Ongoing professional development, whether it be at the county, district, or site level, must include an understanding of Web 2.0 tools, Genius Hour, and/or 20 Time Project, Growth Mindset, and the art of facilitation through open-ended questioning for both teachers and principals.

c) District and site principals incorporate the Genius Hour or 20 Time Project into their leadership/staff meeting to model self-expression/discovery for administrators/teachers to get their creativity flowing.

d) District/site administration model using creative Web 2.0 tools during leadership/staff meetings to provide a starting point for those they lead.

e) Principals and teachers host a 20 Time Project night or Genius Hour for other staff, parents, and community members.

**Recommendations for Further Research**

The following recommendations that were derived from the findings and conclusions of this study are made for further research:
• The lived experiences of current and former LEC middle school teachers in facilitating students’ learning of critical thinking, collaboration, communication, and creativity skills through technological instructional practices in one-to-one classrooms

• The lived experiences of current and former LEC high school teachers in facilitating students’ learning of critical thinking, collaboration, communication, and creativity skills through technological instructional practices in one-to-one classrooms

• A quantitative study of the qualitative finding in this study in which LEC elementary teachers rate the identified technological instructional practices to facilitate students’ learning of critical thinking, collaboration, communication, and creativity skills in one-to-one classrooms

• The lived experiences of current and former LEC principals in improving students’ learning of critical thinking, collaboration, communication, and creativity skills through leadership practice at one-to-one elementary schools

• A qualitative comparative study of the lived experiences of the Digital Educator LEC and non-LEC Digital Educators in relation to teachers’ confidence/self-efficacy to integrate technology into their instructional practices, with a focus on the 4Cs at the elementary level.

• A quantitative comparative study between LEC teachers and non-LEC teachers to determine the effectiveness of the Digital Educator LEC program in relation to teachers’ confidence/self-efficacy to integrate technology into their instructional practices, with a focus on the 4Cs.

• A qualitative phenomenological study to hear students’ stories on the effectiveness of using electronic digital portfolios as a monitoring and self-reflection tool.
Concluding Remarks and Reflections

The literature and research illustrated that in order for the United States to regain its superpower status, we need to prepare our students to think critically, collaborate, communicate, and be creative so they can function successfully in a fluid and ever-evolving digital world. Where do we start? We knew why we needed to change our practice; our students continued to be ill prepared for the workforce. We also knew what we had to focus on, the 4Cs with the integration of technology. However, we did not know the how. We have been struggling with the how for quite some time, since the early 1990s when our world became extremely flat in a short amount of time because of the arrival of the Internet (Friedman, 2007). Being a teacher at heart, I believe teachers want what is best for the students they serve, and they are doing their best with the tools they have. Therefore, it is our job as leaders to support our teachers to improve their practice because the classroom teacher is closest to our children and has the most impact on their learning. Therefore, I can support teachers by trying to find the how to facilitate the 4Cs in our students’ using technology. This led to my study and the research process. Upon reflection on my doctoral journey and most recently the research process, I most enjoyed the time spent with the teachers. I enjoyed listening to their stories and gleaning ideas from them to incorporate into my own leadership practice. After the formal interviews were over, we shared additional stories and practices. It was energizing! Often I would receive an e-mail within the next day or two from several teachers letting me know I had sparked a bit of wonderment, and they wanted to share how they had reflected on their practice or were encouraged to try something we had discussed. What I have rediscovered in this study is that there is no magic bullet but rather refinement and
new renditions of previous practices. Teachers in this study were not using any different instructional strategies than in the past but rather overlaying the instructional practice with a technology tool, hence making a new reiteration. I realized most educators are in constant redesign mode. Why? Because we are naturally curious. We listen to colleagues and we observe their practice; then we take their practice and we create our own version, and then we refine our practice continually.

My doctoral journey has reminded me that we all need to be courageous in our service to children. We, as leaders, need to have an open mind and solicit others’ ideas. We need to view our mistakes and the mistakes of those we serve as learning opportunities. We also need to ask for and provide grace to those we serve. Moreover, we need to embrace the creative struggle of leadership and fail forward!
REFERENCES


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APPENDICES
## APPENDIX A

### Synthesis Matrix

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<td>Prensky, M.</td>
<td>2007</td>
<td>To educate, we must listen: Reflections from traveling the world.</td>
<td>Retrieved from <a href="http://www.marcprensky.com/writing/Prensky-To_Educate,We_Must_Listen.pdf">http://www.marcprensky.com/writing/Prensky-To_Educate,We_Must_Listen.pdf</a></td>
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<td>Quillen, I.</td>
<td>2012</td>
<td>Ed-tech credential effort to start with online teachers.</td>
<td>Education Week.</td>
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<td>pathways [Issue Brief].</td>
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<td>Robinson, K.</td>
<td>2015</td>
<td>Creative schools</td>
<td>New York, NY</td>
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<td>Shulman, L.</td>
<td>1986</td>
<td>Those who understand: Knowledge</td>
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<td>Zhao, Y.</td>
<td><em>Catching up or leading the way: American education in the age of globalization.</em></td>
<td>2009</td>
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<td>Zhao, Y.</td>
<td><em>A world at risk: An imperative for a paradigm shift to cultivate 21st century learners [Special section]. Society,</em></td>
<td>2015</td>
<td>52</td>
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</table>
APPENDIX B

Letter of Invitation

RESEARCH STUDY INVITATION LETTER

Date:

Dear Prospective Study Participant:

My name is Natalie Ruddell, and I am the Coordinator of Digital Learning at Hemet Unified School District, a public K-12 school district. Additionally, I am a doctoral candidate in Brandman University’s Organizational Leadership program.

I am writing to introduce myself to you and to ask if you would be willing to consider participating in this research. You have been invited to participate because you are an elementary school teacher with a Digital Educator Leading Edge Certification. As a practicing educator at a public California elementary school, you have significant expertise and knowledge to contribute to this study. I am asking your assistance in the study by participating in an interview which will take from 45 - 60 minutes and will be set up at a time convenient for you. Additionally, I will ask to receive a copy of lessons plans and/or student work samples.

PURPOSE: The purpose of this phenomenological study is to describe the perceptions of current and former Leading Edge Certified (LEC) elementary school teachers regarding what instructional practices facilitates students’ development of critical thinking, collaboration, communication, and creativity (4 Cs) in one-to-one computer classrooms in Riverside County, California. Results from the study will be summarized in a doctoral dissertation.

PROCEDURES: If you agree to participate in an interview, you may be assured that it will be completely confidential. The interview will be audio-recorded with your consent, and the audio-recording will be destroyed once the interview has been transcribed. A coding system will be used so that no names will be attached to any notes, recording, or transcripts from the interview. All information will remain in locked files accessible only to the researcher and no other individuals will have access to the interview information. You will be free to stop the interview and withdraw from the study at any time.

RISKS, INCONVENIENCES, AND DISCOMFORTS: There are no known major risks or discomforts associated with this research. It may be inconvenient to travel to interviews. However, the session will be held at your school site to minimize this inconvenience. Some interview questions may cause mild emotional discomfort, and sharing your personal experience in may cause some mild discomfort.

POTENTIAL BENEFITS: There are no major benefits to you for participation, but a potential benefit may be that you have an opportunity to contribute to research that may
influence the field education. The information from this study is intended to describe what instructional practices facilitates students’ development of critical thinking, collaboration, communication, and creativity (4 Cs) in one-to-one computer classrooms.

I am available by e-mail and phone to discuss this research. Additionally, my dissertation chair may be contacted to answer any questions you may have: Dr. Phil Pendley, available at pendley@brandman.edu.

It would be an honor to be able to hear your experiences and perspectives regarding what instructional practices facilitates students’ development of critical thinking, collaboration, communication, and creativity (4 Cs) in one-to-one computer classrooms. I know that your time is incredibly valuable and I appreciate your consideration of this request.

Sincerely,
Natalie Ruddell
Doctoral Candidate, Brandman University
E-mail: nrussell@mail.brandman.edu
Phone: ###-####-####
APPENDIX C

Participant’s Bill of Rights

BRANDMAN UNIVERSITY INSTITUTIONAL REVIEW BOARD

Research Participant’s Bill of Rights

Any person who is requested to consent to participate as a subject in an experiment, or who is requested to consent on behalf of another, has the following rights:

1. To be told what the study is attempting to discover.

2. To be told what will happen in the study and whether any of the procedures, drugs or devices are different from what would be used in standard practice.

3. To be told about the risks, side effects or discomforts of the things that may happen to him/her.

4. To be told if he/she can expect any benefit from participating and, if so, what the benefits might be.

5. To be told what other choices he/she has and how they may be better or worse than being in the study.

6. To be allowed to ask any questions concerning the study both before agreeing to be involved and during the course of the study.

7. To be told what sort of medical treatment is available if any complications arise.

8. To refuse to participate at all before or after the study is started without any adverse effects.

9. To receive a copy of the signed and dated consent form.

10. To be free of pressures when considering whether he/she wishes to agree to be in the study.

If at any time you have questions regarding a research study, you should ask the researchers to answer them. You also may contact the Brandman University Institutional Review Board, which is concerned with the protection of volunteers in research projects. The Brandman University Institutional Review Board may be contacted either by telephoning the Office of Academic Affairs at (949) 341-9937 or by writing to the Vice Chancellor of Academic Affairs, Brandman University, 16355 Laguna Canyon Road, Irvine, CA, 92618.
APPENDIX D

Informed Consent Form

CONSENT TO PARTICIPATE IN RESEARCH

BRANDMAN UNIVERSITY
16355 LAGUNA CANYON ROAD
IRVINE, CA 92618

RESEARCH STUDY TITLE: The Lived Experiences of Leading Edge Certified Elementary School Teachers Who Use Instructional Technology to Foster Critical Thinking, Collaboration, Creativity, and Communication in Their Classrooms: A Phenomenological Study

RESPONSIBLE INVESTIGATOR: Natalie Ruddell, Doctoral Candidate

TITLE OF CONSENT FORM: Consent to Participate in Research

PURPOSE OF STUDY: This study is being conducted for a dissertation in Organizational Leadership at Brandman University. The purpose of this phenomenological study was to describe the perceptions of current and former Leading Edge Certified (LEC) elementary school teachers regarding what instructional technology practices facilitates students’ development of critical thinking, collaboration, communication, and creativity in one-to-one computer classrooms in Riverside County, California.

PROCEDURES: In participating in this study, I agree to participate in an interview which will last approximately 45 - 60 minutes and will be audio-recorded (separate privacy statement attached). I also agree to provide a copy of a lesson plan and/or student work sample.

I understand that:

a) The possible risks of this study are minimal. However, there may be some discomfort as a result of participating in the interview. I understand that I do not need to answer any interview questions that cause discomfort.

b) I will not be paid for my participation in this study. The possible benefit of this study is to identify specific instructional practices that facilitates students’ development of critical thinking, collaboration, communication, and creativity in one-to-one computer classrooms. The findings and recommendations from this study will be made available to all participants.

c) Any questions I have concerning my participation in this study will be answered by Natalie Ruddell, doctoral candidate, available by e-mail at
The dissertation chairperson may also answer questions: Dr. Phil Pendley at xxxxx@xxxxxxxx.xxx.

d) I may refuse to participate or may withdraw from this study at any time without any negative consequences. In addition, the investigator may stop the study at any time.

e) I understand that the study will use audio recording of interviews, and the recordings will not be used beyond the scope of this project.

f) I also understand that no information that identifies me will be released without my separate consent and that all identifiable information will be protected to the limits allowed by law. If the study design or the use of the data is to be changed, I will be so informed and my consent re-obtained. I understand that if I have any questions, comments, or concerns about the study or the informed consent process, I may write or call the Office of the Executive Vice Chancellor of Academic Affairs, Brandman University, and 16355 Laguna Canyon Road, Irvine, CA 92618, (949) 341-7641. I acknowledge that I have received a copy of this form and the Research Participant’s Bill of Rights.

I have read the above and understand it. My questions have been answered to my satisfaction and I agree to participate in the study.

________________________________________
Printed Name of Participant/Date

________________________________________
Signature of Participant/Date

________________________________________
Signature of Principal Investigator /Date
APPENDIX E

Interview Script

Oral Interview Script
Brandman University
Doctoral Dissertation

Researcher: Natalie Ruddell
Participant #: ________
Date: ______________

Make personal introductions.

OPENING STATEMENT: [Interviewer states:] I truly appreciate you taking the time to share your story with me. To review, the purpose of this study is to share instructional technology practices to facilitate students’ development of critical thinking, collaboration, communication, and creativity in one-to-one computer classrooms. The questions are written to elicit this information but share stories or experiences as you see fit throughout the interview. Additionally, I encourage you to be as honest and open as possible for purposes of research and since your identity will be remain anonymous.

INTERVIEW AGENDA: [Interviewer states:] I anticipate us being together for approximately 45 minutes to an hour today. As a review of our process leading up to this interview, you were invited to participate via letter and signed an informed consent form that outlined the interview process and the condition of complete anonymity for the purpose of this study. Today, we will first review and discuss the Invitation Letter, Informed Consent Form, Brandman University Participant’s Bill of Rights, and the Audio Release Form. Second, after reviewing all of the forms, you will be asked to sign the required documents for this study, which include the Informed Consent and Audio Release Form. Third, I will officially start the audio recorder and begin asking a series of questions related to instructional strategies that facilitate communication, collaboration, critical thinking, and creativity skills in elementary school students. Although the session is being recorded, I may also take notes during this process. If you feel uncomfortable with me taking notes, please do not hesitate to let me know. Finally, I will turn off the recorder and conclude our session. After your interview is transcribed, you will be provided with a copy of the complete transcripts to check for accuracy in content and meaning prior to me analyzing the data. Please remember, that anytime during this process you have the right to stop the interview. While gaining insights about your experiences is central to this study, my goal is to ensure you feel comfortable during every phase of this process.
DISCUSS, REVIEW STUDY DOCUMENTS, AND OBTAIN SIGNATURE:
[Interviewer states:] Now we will thoroughly review the Invitation Letter, Informed Consent Form, Brandman University Participant’s Bill of Rights, and Audio Release Form. Please take a moment to sign the required documents.

BEGIN INTERVIEW: [Interviewer states:] As we work through the interview questions, there may be language or terms (educational jargon) used that require clarification and calibration. Prior to asking these questions and responding, we will take time to define these terms. Do you have any questions before we begin? Now, I will start the recorder and we will begin the interview. [Begin to ask interview questions]
APPENDIX F

Interview Questions

RESEARCH STUDY TITLE: The Lived Experiences of Leading Edge Certified Elementary School Teachers Who Use Instructional Technology to Foster Critical Thinking, Collaboration, Creativity, and Communication in Their Classrooms: A Phenomenological Study

INSTRUCTIONS: The questions below will be used to address each of the research questions identified for this study. The same questions will be asked during each interview session conducted with certified elementary school Leading Edge Digital Educators. All responses to this interview will be kept confidential.

Background Questions:

1. Share a bit about yourself, both professionally and personally.
2. What aspects of teaching is most rewarding? Most challenging?
3. Describe your journey to becoming a technology-using teacher.

Content Questions:

4. How has becoming a Leading Edge Certificated Digital Educator influenced your teaching practice?
5. Describe successful several lessons/projects were technology was used in your classroom.
   a. What made it successful?
   b. Describe students’ behavior, how were they thinking critically, communicating, collaborating, creating using technology?
6. How frequently would you say you are able to implement the incorporation of the 4Cs and technology into your classroom lessons/projects?
   a. How do you plan lessons incorporating the 4Cs?
      i. What instructional strategies/practices do you find most appropriate to foster the 4Cs in your students within these lessons/projects?
      b. What differences, if any, do you notice in students’ quality of work between a traditional and an integrated lesson/project/assignment?
7. When students are working on a project or assignment, describe how they locate and use online information. (ISTE # 3 – Knowledge Constructor)
   a. What instructional strategies/practices did you find to be most appropriate to foster critical thinking in your students?
   b. Describe how students evaluate an online source?
8. When students are working or interacting online with others, describe their online behavior. (ISTE #2 – Digital Citizen)
a. What instructional strategies/practices did you find to be the most appropriate to foster collaboration and communication in your students?

b. What systems do you have in place to support digital citizenship in your students?

9. When students are presented with real world problems or challenges, describe the process students go through to solve it. (Example: Math - Build shelter for pet) (ISTE # 4 – Innovative Designer)
   a. What instructional strategies/practices did you find to be most appropriate to foster critical thinking and creativity in your students?

10. Describe how students use technology to collect, analyze and represent relevant information for their assignments/projects. (ISTE # 5- Computational Thinker)
    a. What instructional strategies/practices did you find to be most appropriate to foster critical thinking and communication in your students?

11. What kinds of digital artifacts do students produce to communicate their learning? (ISTE #6 – Creative Communicator)
    a. What instructional strategies/practices did you find to be most appropriate to foster communication and creativity in your students?
    b. Describe how students select tools to communicate.
    c. Describe students’ awareness of audience when creating and communicating their learning.

12. In what ways do students collaborate with others from diverse backgrounds? (ITSE # 7 – Global Collaborator)
    a. What instructional strategies/practices did you find to be most appropriate to foster collaboration in your students?

13. In your opinion, what do you think is the impact of teaching critical thinking, collaboration, creativity, and communication skills on student learning?

Conclusion:
14. What should I have asked you that I did not think to ask?
## APPENDIX G

### Alignment of Interview and Research Questions

<table>
<thead>
<tr>
<th>Interview Questions</th>
<th>RQ 1 Critical Thinking</th>
<th>RQ 2 Collaboration</th>
<th>RQ 3 Communication</th>
<th>RQ 4 Creativity</th>
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<tbody>
<tr>
<td>1. Describe your journey to becoming a technology-using teacher. (Background)</td>
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<td>2. Describe successful lessons/projects where technology was used in your classroom. Probes:</td>
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<td>• What made it success?</td>
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<td>• Students communicating</td>
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<td>• Students collaborating</td>
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<td>• Students being creative</td>
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<tr>
<td>• Students critically thinking</td>
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<td>3. How frequently would you say you are able to implement the incorporation of the 4Cs and technology into your classroom lessons/projects? Probes:</td>
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<td>• How do you plan a lesson incorporating the 4Cs?</td>
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<td>• What instructional strategies/practices did you find to be most appropriate to foster the 4Cs in your students within these lessons/projects?</td>
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<td>4. When students are working on a project or assignment, describe how they locate and use online information. (ISTE # 3 – Knowledge Constructor) Probe:</td>
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<td>• What instructional strategies/practices did you find to be most appropriate to foster critical thinking in your students?</td>
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<td>5. When students are working or interacting online with others, describe their online behavior. (ISTE #2 – Digital Citizen) Probes:</td>
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<td>• What instructional strategies/practices did you find to be most appropriate to foster collaboration and communication in your students?</td>
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<td>What systems do you have in place to support digital citizenship in your students?</td>
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<td>6.</td>
<td>When students are presented with real world problems or challenges, describe the process students go through to solve it. (ISTE # 4 – Innovative Designer) Probes:</td>
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<td>• What instructional strategies/practices did you find to be most appropriate to foster critical thinking and creativity in your students?</td>
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<td>7.</td>
<td>Describe how students use technology to collect, analyze and represent relevant information for their assignments/projects. (ISTE # 5 – Computational Thinker) Probes:</td>
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<td>• What instructional strategies/practices did you find to be most appropriate to foster critical thinking and communication in your students?</td>
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<td>8.</td>
<td>What kinds of digital artifacts do students produce to communicate their learning? (ISTE #6 – Creative Communicator) Probes:</td>
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<td>• What instructional strategies/practices did you find to be most appropriate to foster communication and creativity in your students?</td>
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<td>9.</td>
<td>In what ways do students collaborate with others from diverse backgrounds? (ITSE # 7 – Global Collaborator) Probes:</td>
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<td>• What instructional strategies/practices did you find to be most appropriate to foster collaboration in your students?</td>
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10. In your opinion, what do you think is the impact of teaching critical thinking, collaboration, creativity, and communication skills on student learning?  

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11. What should I have asked you that I did not think to ask?

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APPENDIX H

Letter of Invitation

EXPERT PANEL INVITATION LETTER

Study: The Lived Experiences of Leading Edge Certified Elementary School Teachers Who Use Instructional Technology to Foster Critical Thinking, Collaboration, Creativity, and Communication in Their Classrooms: A Phenomenological Study

Date:

Dear Potential Expert Panelist:

This letter is to invite you to participate in a qualitative phenomenological research study as a professional expert. My name is Natalie Ruddell, and I am a doctoral candidate in the Organizational Leadership Doctoral program at Brandman University. I am currently conducting research under the supervision of Dr. Phil Pendley to discover instructional practices that facilitates students’ development of critical thinking, collaboration, communication, and creativity (4 Cs) in one-to-one computer classrooms.

What is the purpose of this research study?
The purpose of this phenomenological study was to describe the perceptions of current and former Leading Edge Certified (LEC) elementary school teachers regarding what instructional technology practices facilitates students’ development of critical thinking, collaboration, communication, and creativity (4 Cs) in one-to-one computer classrooms in Riverside County, California.

What will your involvement in this study mean?
Participating as the professional expert involves discussing, reviewing and developing the research questions and pilot test. The process of involving experts helps to minimize researcher bias and helps protect the safety of the research participants. I would like you to review and scrutinize the interview questions and provide feedback on improving the questions. Upon the completion of a pilot test, I will share the results with you and ask for feedback after reviewing the data to ensure the reliability and validity of the instrument.

While participating in this study is completing voluntary, there may be minimal risks involved to the participants. Your participation as the expert in the field will minimize these risks.

If you have any questions regarding this qualitative phenomenological study, please do not hesitate to call me at (###) ###-#### or by e-mail at xxxxx@xxxxxxx.xxx. You can also contact Dr. Phil Pendley at xxxxx@xxxxxxx.xxx.

Thank You for your consideration and assistance in this qualitative phenomenological study.

Sincerely,
Natalie Ruddell
APPENDIX I

Brandman Institutional Review Board Approval

BRANDMAN UNIVERSITY INSTITUTIONAL REVIEW BOARD
IRB APPLICATION ACTION – APPROVAL
COMPLETED BY BUIRB

IRB ACTION/APPROVAL

Name of Investigator/Researcher: Natalie Ruddell

☐ Returned without review. Insufficient detail to adequately assess risks, protections and benefits.
☐ Approved/Certified as Exempt form IRB Review.
☒ Approved as submitted.
☐ Approved, contingent on minor revisions (see attached)
☐ Requires significant modifications of the protocol before approval. Research must resubmit with modifications (see attached)
☐ Researcher must contact IRB member and discuss revisions to research proposal and protocol.

Level of Risk: ☐ No Risk ☐ Minimal Risk ☐ More than Minimal Risk

IRB Comments:

IRB Reviewer: ____________________________

Telephone: ____________________________ Email: ____________________________

BUIRB Chair: ____________________________ Date: 1/12/2017

REVISED IRB Application ☐ Approved ☐ Returned

Name: ____________________________

Telephone: ____________________________ Email: ____________________________ Date: ______________

BUIRB Chair: ____________________________

The National Institutes of Health (NIH) Office of Extramural Research certifies that
Natalie Ruddell successfully completed the NIH Web-based training course
"Protecting Human Research Participants".

Date of completion: 07/03/2015.

Certification Number: 1793378.
APPENDIX K

Interview Outline

**Research Study Title:** The Lived Experiences of Leading Edge Certified Elementary School Teachers Who Use Instructional Technology to Foster Critical Thinking, Collaboration, Creativity, and Communication in Their Classrooms: A Phenomenological Study

These are the general questions that will be discussed during the interview. If you choose, you may review the questions prior to the interview. Please be aware the researcher, may ask follow-up questions in any of the areas in order to better understand your responses.

**Part I: Background of Practice**

- Share a bit about yourself, both professionally and personally.
- What aspects of teaching is most rewarding?
- What aspects of teaching is most challenging?
- Describe your journey to becoming a technology using teacher.
  - How has becoming a Leading Edge Certificated Digital Educator influenced your teaching practice?
- Describe successful several lessons/projects were technology was used in your classroom.

**Part II: Instructional Practices that Facilitates Students’ Development of Critical Thinking, Collaboration, Creativity, and Communication**

This study draws from the Partnership for 21st Century Learning (P21) and the International Society for Technology in Education (ISTE) work around skills students need to be prepared for college and career: critical thinking, collaboration, creativity, and communication. The LEC for Digital Educators aligns to the work of P21 and ISTE and its purpose is to focus is to support teachers in fostering the 21st-century skills of critical thinking, collaboration, creativity, and communication in their students.

- Describe several successful lessons/projects were technology was used in your classroom.
- Describe students’ behavior, how were they thinking critically, communicating, collaborating, creating using technology?
- How frequently would you say you are able to implement the incorporation of the 4Cs and technology into your classroom lessons/projects?
- How do you plan lessons incorporating the 4Cs?
- What instructional strategies/practices do you find most appropriate to foster the 4Cs in your students within these lessons/projects?
- When students are working on a project or assignment, describe how they locate and use online information.
• When students are working or interacting online with others, describe their online behavior. (ISTE #2 – Digital Citizen)
• What systems do you have in place to support digital citizenship in your students?
• When students are presented with real world problems or challenges, describe the process students go through to solve it. (Example: Math - Build shelter for pet) (ISTE # 4 – Innovative Designer)
• Describe how students use technology to collect, analyze and represent relevant information for their assignments/projects. (ISTE # 5- Computational Thinker)
• What kinds of digital artifacts do students produce to communicate their learning? (ISTE #6 – Creative Communicator)
• Describe how student select tools to communicate.
• Describe students’ awareness of audience when creating and communicating their learning.
• In what ways do students collaborate with others from diverse backgrounds? (ITSE # 7 – Global Collaborator)
• In your opinion, what do you think is the impact of teaching critical thinking, collaboration, creativity, and communication skills on student learning?

**Part III: Overall Conclusions**

The interview will conclude with some general overarching discussion as well as for you to share any additional insights, comments or questions.
APPENDIX L

Audio Release Form

RESEARCH STUDY TITLE: The Lived Experiences of Leading Edge Certified Elementary School Teachers Who Use Instructional Technology to Foster Critical Thinking, Collaboration, Creativity, and Communication in Their Classrooms: A Phenomenological Study

BRANDMAN UNIVERSITY
16355 LAGUNA CANYON ROAD
IRVINE, CA 92618

I authorize Natalie Ruddell, Brandman University Doctoral Candidate, to record my voice. I give Brandman University and all persons or entities associated with this research study permission or authority to use this recording for activities associated with this research study.

I understand that the recording will be used for transcription purposes and the information obtained during the interview may be published in a journal/dissertation or presented at meetings/presentations.

I will be consulted about the use of the audio recordings for any purpose other than those listed above. Additionally, I waive any right to royalties or other compensation arising correlated to the use of information obtained from the recording.

By signing this form, I acknowledge that I have completely read and fully understand the above release and agree to the outlined terms. I hereby release any and all claims against any person or organization utilizing this material.

_________________________  ________________________
Signature of Participant or Responsible Party  Date
APPENDIX M

Symabloo Online Web 2.0 Tool to Censor Online Sites

Water Cycle Symbaloo
Create a Symbaloo with resources on the water cycle.
* at least 1 article
* at least 1 science experiment
* at least 1 game
* at least 3 videos - not from the same website
* one picture showing each of the following:
  - evaporation
  - condensation
  - precipitation
  - collection

Symbaloo - Your Bookmarks and favorites in the cloud
https://www.symbaloo.com/home/mix/13eOeK1fV
APPENDIX N

Brainstorming Web Using Google Doc for Problem Solving

- The astronaut's helmet helps the astronaut breathe.
- This safety rope helps them get around in space just in case they float away.
- The hard upper torso is kind of the main thing in the suit because it helps keep the air inside the suit.
- Gloves help the astronauts' hands to be warm and helps from pressure.
- These boots are heavy so they keep the astronauts from floating away.
- These thrusters help the astronauts get around in space.
- This liquid proof suit is an extra layer to keep the astronauts warm.
- The suit keeps the astronauts warm and astronauts from the effects of space.
### APPENDIX O

**Self-Reflection Tool—Rubric for Group Presentation**

Evaluator Name: ______________________

Author Name: ______________________

#### Grading Rubric for Google Slides Project

<table>
<thead>
<tr>
<th></th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>Total:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Content</strong></td>
<td>Knowledge of topic is both detailed and accurate.</td>
<td>Knowledge of topic is somewhat detailed and accurate.</td>
<td>Knowledge of topic is slightly detailed and somewhat accurate.</td>
<td>Knowledge of topic is not detailed or accurate.</td>
<td></td>
</tr>
<tr>
<td><strong>Slide Creation</strong></td>
<td>Slides are visually pleasing, have graphics/pictures, and transitions. There is a title slide, a slide for each inquiry, and a research slide.</td>
<td>Slides are visually pleasing and have either graphics/pictures or transitions. There is a title slide and a research slide but not a slide for every inquiry.</td>
<td>Slides are visually pleasing and have either graphics/pictures or transitions. There is a title slide but inquiry slides are missing and/or research slide.</td>
<td>Slides are not visually pleasing and are missing graphics/pictures or transitions. Several slides are missing - title, inquiry, and research.</td>
<td></td>
</tr>
<tr>
<td><strong>Language Conventions</strong></td>
<td>No spelling errors. No grammar errors. Text is in author's own words.</td>
<td>Few spelling errors. Few grammar errors. Text is in author's own words.</td>
<td>Several spelling errors. Several grammar errors. Text is in author's own words.</td>
<td>Many spelling errors. Many grammar errors. Text is not an author's own words.</td>
<td></td>
</tr>
<tr>
<td><strong>Research</strong></td>
<td>At least 3 resources are cited. Citations are in proper MLA format.</td>
<td>At least 3 resources are cited. Citations are not in proper MLA format.</td>
<td>At least 2 resources are cited. Citations are not in proper MLA format.</td>
<td>Only one resource cited. Resource not in MLA format.</td>
<td></td>
</tr>
</tbody>
</table>

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APPENDIX P

Cooperative Groups’ Expectations

Give thoughtful feedback
Respect others’ ideas and materials
On task all the time
Use soft voices; take turns
Participate actively
Stay with your group
APPENDIX Q

Shared Presentation Tools

Desert by: Student

The desert is an ecosystem that is hot and dry, yet full of life. Cactus have long shallow roots to get water when it rains and it can hold water inside. There are many kinds of cactus for example barrel, prickly pear, saguaro are just a few. Did you know that some animals hide in cacti? Some-times owl's hide inside cacti, also do small animals. Did you know that some reptiles live in the desert? Well, lizards live in deserts and sakes and more animals we don't need to menchen. Wow, did you know there is so much life in the desert?

Gila monsters have a venomous bite.

Glossary
Ecosystem: a place where a animal lives or where a plant lives.
APPENDIX R

Common Sense Media—Digital Footprint

The Power of Words (3-5)

What should you do when someone uses mean or scary language on the Internet?

Students consider that they may encounter online messages from other kids that can make them feel angry, hurt, sad, or fearful. They explore ways to handle cyberbullying and how to respond in the face of upsetting language online. Students discuss all the ways they use technology for communication, put themselves in the shoes of children who are cyberbullied on a kids’ game website, and explore both the similarities and differences between in-person versus online communication. Students then brainstorm ways to respond to cyberbullying.