Fall 8-29-2018

Technology Integration: A Mixed Methods Study of Best Practices of Technology Integration as Perceived by Expert Middle School Teachers

Carliza Bataller
Brandman University, bata8801@mail.brandman.edu

Technology Integration: A Mixed Methods Study of Best Practices of Technology Integration as Perceived by Expert Middle School Teachers

A Dissertation by

Carliza Bataller

Brandman University

Irvine, California

School of Education

Submitted in partial fulfillment of the requirements for the degree of

Doctor of Education in Organizational Leadership

August 2018

Committee in charge:

Cindy Petersen, Ed.D. Committee Chair

Keith Larick, Ed.D.

Donna Sonnenburg, Ed.D.

BRANDMAN UNIVERSITY

Chapman University System

Doctor of Education in Organizational Leadership

The dissertation of Carliza Bataller is approved.

Cindy L. Petersen, Dissertation Chair
Cindy Petersen, Ed.D.

Keith Larick, Committee Member
Keith Larick, Ed.D.

Donna Sonnenburg, Committee Member
Donna Sonnenburg, Ed.D.

Patricia Clark-White, Associate Dean
Patricia Clark-White, Ed.D.

August 2018

Technology Integration: A Mixed Methods Study of Best Practices of Technology Integration as perceived by Experts Middle School Teachers

by Carliza Bataller

ACKNOWLEDGEMENTS

This paper would have never been written without the support, dedication, and care of many individuals in my life. I want to acknowledge the amazing, Superintendent Leader, Dr. Cindy Petersen. A person could not ask for a better chair. Her patience, expertise, and feedback allowed me to take this paper from concept to completion. Her understanding of what I wanted to do helped guide me when I began to get lost. I would not have been able to accomplish this difficult challenge without her editing, encouragement, and support. She is a true educator, lifelong learner, and an inspiration to many students and future leaders.

To my cohort family, you have the patience of saints, the ability to turn an okay idea into a better piece of writing, and the intellect people can only hope to have. I am lucky to have you on my side and as friends. You all helped me each year to progress through this program and help me craft my concept for this paper; for that I am so grateful to have had you as a learning group and exemplar models of a leader. You are brilliant and such a wonderful set of friends. It has been quite a journey one that I could not have done without you.

Sharon Herpin I am so grateful for your help and carrying me through the finish line. Your expertise is priceless, and I am forever grateful for your stellar direction and finesse in guiding me to the end!

To my Professional work family, thank you for your patience as I struggled through this program and used you as guinea pigs. You have taught me a lot and I am incessantly grateful for everything each of you has done to support me. Everyone I work

with daily, I thank you for your mentorship, leadership, and encouragement. I am one fortunate person!

Shirley Bargamento, Mom, you have given me the love for education and the opportunity to receive it. I am so grateful to have you as my mom. You have given me an amazing life, a stable home to grow up in, and the foundation of love in my home. I have looked up to you as the person who has provided me with the best in life. Thank you for all you have done over my life to get me to this day. Regino Bataller, dad, your dreams for me carry me forward. Thank you for always believing in me and wanting more for me even when I couldn't see it!

Thank you to my brilliant and incredibly beautiful daughter, Raquel, her gifted, kind, and wise husband, Mike (the best son-in-law the world) and my amazing, funny, and incredible grandsons, Trent and Brock. You are my reasons for living, my heart and soul, and the reason this world is so beautiful. You all motivate me to be better at everything I do. I love you to infinity and beyond.

To all my family and friends, I could not have made it without you, your unconditional love and support, and understanding that I was working on something new and unknown to me and despite that you kept encouraging me and cheering me on. You all have pushed me, prayed for me, and inspired me to accomplish what at times seemed like the impossible. I thank God for the blessing of all of you and the learning I have and continue to do.

To all of you, I am eternally grateful!

ABSTRACT

Technology Integration: A Mixed Methods Study of Best Practices of Technology Integration as perceived by Experts Middle School Teachers

by Carliza Bataller

Purpose: The purpose of this mixed methods sequential explanatory study was to identify and describe best practices in technology integration in middle school classrooms as perceived by expert middle school teachers. Additionally, it was the purpose of the study to determine the most important best practices and perceived barriers to successful technology integration as perceived by expert middle school teachers.

Methodology: This study included a survey sent to 34 middle school teachers from five counties in northern California who were considered experts in technology integration. Data were gathered from the initial survey instrument and followed up by interviews with participant volunteers.

Findings: Findings from this study suggested middle school best practices for technology integration need to include equitable access, structure and clear limits, and content mastery and 21st century skill development learned through project/problem-based, student-centered inquiry utilizing a variety of technology applications and/or a learning management system.

Conclusions: The conclusions from this study suggested successful middle school technology integrated learning activities/lessons need to incorporate adolescent developmental needs for students to thrive. Expert middle school technology integration teachers stated the most important best practice was utilizing tech-infused, authentic,

real-world project/problem issues relevant to today's world while incorporating core content through learning opportunities engaging to adolescents.

Recommendations: Future research should include a correlational study to examine frequency and type of technology use by teachers and students to identify any relationships that exists, and to identify ways to increase the frequency of student technology use in the classroom. Another recommendation is to conduct a phenomenological study from the middle school student perspective regarding use of technology both inside and beyond the school day. Conduct a multi-case mixed methods explanatory study describing best practices for technology integration across three identified levels (K-5, 6-8, 9-12) providing a more comprehensive perspective across the K-12 system. A case study should be done of three high-performing middle schools to identify and explore key technology integration practices teachers. Lastly, it is recommended to conduct a mixed methods study of middle school principals who deployed 1:1 initiatives to identify and describe the best practices for leading a 1:1 technology initiatives.

TABLE OF CONTENTS

CHAPTER I: INTRODUCTION 1
Background 3
Globalization 3
Globalization and Education 3
Evolution of Education 4
Today's Educational Environment 5
Technology in Education 5
History of Technology Integration in U.S. Education 6
Middle School History 7
Developmentally Unique Middle School Students 7
Middle School Population: A Unique Generation of Digital Natives 8
Technology Integration Best Practices Promote Changing Teacher Role 8
Technology Integration Models and Standards of Practice 9
Technology Models 10
Technology Integration in Middle School 12
Barriers Causing Ineffective Technology Integration 14
Statement of the Research Problem 16
Research Gap 17
Purpose Statement 18
Research Questions 18
Significance of the Problem 18
Definitions 20
Delimitations 21
Organization of the Study 22

CHAPTER II: REVIEW OF THE LITERATURE 23
Globalization 24
Globalization and Education 25
Evolution of Education 28
What Happened in Education Over the Past Twenty Years 28
Today's Educational Environment 30
Technology Integration in Education 31
History of Technology Integration in U.S. Education 31
Middle School History 34
Developmentally Unique Middle School Students 37
Middle School Population: A Unique Generation of Digital Natives 41
Technology Integration Best Practices 42
Technology Integration Promotes Changing Teacher Role 53
Technology Integration Models and Standards of Practice 56
Technology Integration Best Practices in in Middle School 64
Effective Use of Computer and/or Web-Based Applications 64
Barriers to Technology Integration 68
Access 69
Vision 71

Beliefs 71
Time 72
Professional Development 72
Summary 73

CHAPTER III: METHODOLOGY 74
Purpose Statement 74
Research Questions 74
Research Design 75
Quantitative Research 76
Qualitative Research 76
Population 77
Sample 79
Instrumentation 81
Quantitative Instrumentation 81
Qualitative Instrumentation 82
Validity 83
Reliability 85
Data Collection 86
Quantitative Data Collection 86
Qualitative Data Collection 87
Ethical Considerations 87
Data Analysis 88
Quantitative Data Analysis 89
Qualitative Data Analysis 89
Limitations 90
Summary 91

CHAPTER IV: RESEARCH, DATA COLLECTION, AND FINDINGS 92
Purpose Statement 92
Research Questions 93
Methodology 93
Presentation and Analysis of Data 94
Findings for Research Question 1 95
Findings for Research Question 2 104
Findings for Research Question 3 122
Summary 125

CHAPTER V: FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS 126
Purpose and Research Questions 126
Methodology 127
Major Findings 127
Unexpected Findings 138
Conclusions 138
Implications for Action 141
Recommendations for Further Research 144
Concluding Remarks and Reflections 145

REFERENCES 148

APPENDICES 177

LIST OF TABLES

Table 1. Expert Teacher Practices 55

Table 2. Technology Integration Levels 63

Table 3. Enrollment and Number of Public Schools by Type: 2014-15 78

Table 4. County and Number of Middle Schools 79

Table 5. Frequency of Teacher and Student Technology Use 95

Table 6. Teacher Modeling of Digital Citizenship 96

Table 7. Participant Use of Digital Tools and Resources (ISTE Standard 6) 97

Table 8. Technology Used Interactively 98

Table 9. Support of Student Learning Experiences and Assessments 99

Table 10. Student Use of Technology for Research and Problem-Solving 100

Table 11. Technology Applications Used with Students 101

Table 12. Adolescent Needs Addressed in the Classroom 102

Table 13. Digital Generation Needs Addressed in the Classroom 103

Table 14. 21st Century Skills Addressed in the Classroom (ISTE Standards 1,3,4,5,7). 104

Table 15. Importance of Modeling Digital Citizenship (ISTE Standards 1,2,7) 105

Table 16. Practices Used to Support Success with Digital Tools and Resources 107

Table 17. Practices to Support Student Success in Meeting the Learning Objectives ... 108

Table 18. Practices in Support of Effective Student Learning and Assessments 109

Table 19. Technology for Research and Problem-Solving (ISTE Standards 3,4,5) 111

Table 20. Addressing Needs of Adolescents (ISTE Standards 2,5) 113

Table 21. Addressing the Needs of the Digital Generation (ISTE Standards 1,6) 116

Table 22. Addressing 21st Century Skills in the Classroom (ISTE Standards 3,5,7) 116

Table 23. Most Successful Technology-Based Lesson/Learning Activity 118

Table 24. Reasons for Successful Technology Integrated Lessons 119

Table 25. Judging the Effectiveness of Lessons based on Student Achievement 120

Table 26. Technology Tools Used for their Most Successful Lesson 121

Table 27. Skills Taught to Students to use Technology..... 122

Table 28. Barriers to Integrating Technology into Teaching and Learning 123

LIST OF FIGURES

Figure 1. How New Pedagogies are Different 26

Figure 2. TPACK Framework Interweaving Technology, Content, and Pedagogy 58

Figure 3. Sequential Explanatory Mixed Methods Research Design. 75

Figure 4. Graphic Representation of Narrowing from Population to Sample. 81

CHAPTER I: INTRODUCTION

To give our children the chance to live out their dreams in a world that's never been more competitive, we will equip tens of thousands of schools, community colleges, and public universities with 21st century classrooms, labs, and libraries. We'll provide new computers, new technology, and new training for teachers so that students in Chicago and Boston can compete with kids in Beijing for the high-tech, high-wage jobs of the future.

—President Barack Obama

The 20th century exploded with technological breakthroughs and scientific discoveries that changed history (Digital History, 2016). These changes now challenge educators in how to provide the best education possible utilizing technology to enhance the learning environment and support the development of college- and career-ready students (EdTech Review, 2016). Educators need to embrace effective, current, and emerging methodologies, innovations, and technologies as opportunities to support deep levels of student engagement and learning (Edutopia, 2007; Hertz, 2010; Hew & Brush, 2007; Javeri & Persichitte, 2007). Most educators recognize education must mirror the social and technological changes occurring and effectively apply them to students in a developmentally appropriate manner (Javeri & Persichitte, 2007).

Over the last century, technology dramatically changed the way young people live. Technology created new necessities and practices of aligning student expectations of engagement in education, which took on myriad forms to meet the needs of students known as digital natives, also known as Generation Z (Ito et al., 2008; Williams, 2015). Students currently in middle school are identified as Generation Z digital natives due to being raised during the age of digital innovations; they are familiar with computers, the Internet, and computer applications from an early age (Ito et al., 2008). This generation of students expects learning to be engaging and to provide explicit and implicit learning

experiences individualized at their level, while being integrated with technology in every facet of their education (Nemko, 2014; Williams, 2015). This is the reality in communities across the nation (Nemko, 2014). The time has come to support transformation in the American educational system, where technology supports student learning of critical skills wherein they are better prepared for the future.

Student lives are changing because of technology; to keep pace with these changes, it is essential to align teaching and learning experiences relevant to students (Horst et. al., 2008). These changes force educators to make decisions regarding instructional practices in conjunction with the use of technology to ensure the greatest impact on deeper learning environments (Fullan & Donnelly, 2013). These environments must engage students to render positive results for student learning and need daily examination (Dede, 2014). The problem is not whether to use technology, but rather how technologies should be used to support instructional outcomes (Javeri & Persichitte, 2007).

The best way to invest in new technologies for deeper learning is to begin by acknowledging context matters and tools must be flexible enough to serve the given school, teachers, students, curriculum, and culture (Fullan & Donnelly, 2013). In short, such tools should be designed with local adaptations in mind (Dede, 2014; United States Department of Education [USDE], 2010). A plethora of both potential and opportunities exist to use technology to change the nature of learning, although the evidence of what works is still emerging, which is why discovering best practices used by teacher experts of technology integration in middles school classrooms is essential.

Background

This section contains a brief overview of the literature to set the stage for the research study. It begins with globalization and moves through globalization in education, evolution of education, today's educational environment, technology integration, history of technology integration in education, middle school history, developmentally unique middle school students, generation of digital natives, technology integration best practices, technology integration models and standards of practice, technology integration in middle school, and barriers causing ineffective technology integration.

Globalization

Scudero (2015) suggested economic globalization was the catalyst for change mandating why teaching and learning can no longer be the skill development of the past. This change driver makes it necessary to shift learning from preparation of skilled factory work to work in a global society based on technology (Dede, 2014; Ferdig & Kennedy, 2014; Scudero, 2015). Innovative uses of technology with access of all types of information through the Internet accelerated the ability to communicate, exchange commerce, and understand cultures, and it drives the world today in a knowledge economy like never before (Burbules & Torres, 2000; Fullan, 2013; Wood, 2008). Technology and the use of the Internet is expanding globalization and driving the need to change education.

Globalization and Education

The previous century differed in the skill set needed to go to college and find a job (Partnership for 21st Century Skills [P21], 2011). Prior to the 1960s, the workforce

provided jobs where employees were able to remain for their entire career. People held the same position with the same company until they retired (Friedman & Mandelbaum, 2011; P21, 2011). With the combination of globalization and information technology, the world changed, evolving into a global economy driven by innovative industries, services, products, markets, and politics (Friedman & Mandelbaum, 2011; Mahunik, 2014). These changes resulted in an employment-poor society where the market expects more for less, more products and service for less money, resulting in fewer jobs (Friedman & Mandelbaum, 2011; P21, 2011). "The need for different societies to compete in a world where knowledge is a principle currency has turned the organization and purpose of education systems into key factors for relative competitiveness" (Welmond, 2002, p. 39).

Evolution of Education

Over the past 50 years, the pendulum of changes in education went from no standards, to recognizing the need for standards, to extreme accountability measures under No Child Left Behind (Cennamo, Ross, & Ertmer, 2014). To equalize education nationwide and ensure equitable educational opportunities for all students, passing the test became the focus, which resulted in loss of skill development that led to college and/or career (Friedman & Mandelbaum, 2011). Students were faced with having to remediate their education to meet the needs of the workforce to get a job or be accepted into college to compete in the global market place (Freidman & Mandelbaum, 2011; USDE, 2010). In other words, the public school system was missing the mark in preparing U.S. students to be college- and career-ready (P21, 2011).

Today's Educational Environment

America's public schools continued to grow in population of students (USDE, 2010), but fundamentally little else changed. Traditional constructs include fixed grades, rigid curriculum, and teachers who are keepers and distributors of knowledge (Fullan, 2013; Goleman & Senge, 2014). America's public schools are tasked to educate diverse students despite increasing class sizes, persistent poverty, educational inequality, widening achievement gaps, changing family patterns, inadequate community supports, limited technology, cultural diversity, English language learners, safety issues, and changing demographics (Darling-Hammond, 2010).

The challenge of meeting the individual needs of a whole child while differentiating instruction and integrating technology is creating innovations for teaching and learning at a time when the nation is struggling to yield a productive, skilled workforce to compete in a rapidly changing global community (Darling-Hammond, 2010). These struggles and challenges stimulate education technology policies to support development of an innovative and effective public education system to provide students with the skills to compete in the 21st century global economy (Darling-Hammond, 2010; Wenglinski, 2005).

Technology in Education

Technological advances brought about many design changes and new methods to education (Windschitl & Sahl, 2002). The use of technology in the classroom changed significantly over the past few decades from its beginning in the 1960s (Becker, 2001). Regarding hardware, the public education system went from no computers, to one computer in an entire school, to computer labs, and evolving more recently toward a

one-to-one student to computer ratio (Becker, 2001). Technology innovations and integrations rapidly changed in the last 20 years; prior to the Internet, technology in the classroom consisted of films or visual and auditory aids. After the 1970s, computers started entering schools and now Internet enabled devices are in the hands of students (Gray, Thomas, & Lewis, 2010). The need to continue to change learning in classrooms to match the world students will live in is essential, and to discover how and what that looks like specifically at the middle school level could greatly help.

History of Technology Integration in U.S. Education

The last 20 years represented a boom of educational technology integration, which grew in use and availability with Internet access and more powerful computers (Chung, 2007). Prior to the Internet, technology in the classroom consisted of visual aids used on an overhead projector, films seen on movie cameras shared among buildings, and/or lantern slides that provided pictures to enhance the topic of learning. The use of radios, videocassette recorders, and televisions supported the delivery of instruction into the learning environment (Chung, 2007). In the 1960s, the visionary work of coding with students became the catalyst of integration of technology using computers to enhance learning and its use in the classroom (Boss, 2011; Chung, 2007; Reiser & Dempsey, 2007). After the 1970s, computers started entering schools and now it is common practice for students to research on their own devices and use the Internet to gather information (Boss, 2011). Technology innovations changed the tools used in learning, evolving from one computer in the school to having devices in the hands of each student with the goal of using one-to-one technology in conjunction with a learning

management system (International Society for Technology in Education [ISTE], 2016; USDE, 2017).

Middle School History

Middle school education in the United States evolved from the one room schoolhouse to divisions in grade level grouping based on developmental needs of students (Gloer, 2007). The origins of United States educational grouping by developmental needs led to the categorization into specific grade levels; elementary was distributed over eight years and high school distributed into four levels (Yecke, 2005). Middle school philosophy found its beginning in the early 1900s with the first intermediate school constructed circa 1895; however, conservative researchers suggested these schools called in-between schools first surfaced in the United States closer to the 1910s (Gloer, 2007). Middle school continues to evolve and success in academic arenas are proving middle schools are remarkable academic institutions supporting the overall wellbeing of students; results showed positive outcomes when focused on specific evidenced-based practices in a nurturing environment inspired a love of learning and stimulated curiosity, creative processes, and reasoning (Drolet & Arcand, 2012; EdSource, 2010; Meyer, 2011; Piaget, 1952, 1960).

Developmentally Unique Middle School Students

Child development theorists described the ages of individuals from 11 to 18 years old as adolescence, a time when growth of strength, cognitive competencies, and sense of purpose formed. Middle school focuses on the developmental needs of youths in early adolescents, ages 10 to 14 (Lee & Smith, 1993). Through the developmental process, many competing themes are evolving. These interdependent themes

adolescents struggled with are intellectual, biological, physiological, emotional, social, and academical processes (Lee & Smith, 1993). Understanding adolescent development is critical for adults and educators who support them in that they can continue to educate young adults in their journey through these tumultuous years (Fitzgerald, 2005).

Middle School Population: A Unique Generation of Digital Natives

Another factor to consider is the generation of students currently in schools. This upcoming generation is different from others who came before (Ito et al., 2008). Advancements in information, communications, and technology changed how they live (Buckingham, 2007; Ito, 2013; Ito et al., 2008; Velez, 2012). Social life is inundated with social media such as Facebook, Twitter, and LinkedIn (Buckingham, 2007, Velez, 2012). People can view into the lives of each other quickly and regularly, without ever physically being in each other's presence (Ito et al., 2008). Technology is pervasive; recognizing and including this in making education relevant to students as they grow and prepare for the future is vital. Identifying best practices effective for middle school technology integrated classrooms is a necessity (Simmons & Blythe, 2008; Strahan, L'Esperance, & Van Hoose, 2009; Tanner, 1973).

Technology Integration Best Practices Promote Changing Teacher Role

The model of education where the teacher transmits information through lectures and textbooks is ineffective for student learning (Bellanca & Brandt, 2010; Detwiller, 2007; Saavedra & Opfer, 2012; Velez, 2012). Additionally, the role of technology in the classroom and effective use and implementation practices by educators is crucial to how it influences student learning (Detwiller, 2007). Strategies such as inquiry-based and problem-based learning take a different approach from the traditional classroom. These

new ways of teaching in a technology rich classroom foster a successful transition from a teacher-centered environment to a learner-centered environment (Hirumi, 2002; Jones, 2006; Saulnier, 2008). Fullan and Donnelly (2013) identified the teacher role becoming a change agent, an activator of learning. This role includes activities that involve reciprocal teaching where teacher and student learn from each other, ongoing feedback, verbal interactions, meta-cognition to make the thinking process explicit, and challenging goals where both teacher and student participate in setting ambitious and achievable goals.

Effective technology integration must happen across the curriculum in ways that deepen and enhance the learning process (Fullan, 2013; Marzano, 2015). It must support four key components of learning: (a) active engagement, (b) participation in groups, (c) frequent interaction and feedback, and (d) connection to real-world experts (Marzano, 2015). Effective technology integration is achieved when the use of technology is routine and transparent, and when technology supports curricular goals (Earle, 2002; Edutopia, 2014; Ertmer, 2005). Rose (2008) concluded, "More research that highlights the best practices of teachers who use technology successfully…is needed" (p. 116).

Technology Integration Models and Standards of Practice

Performance indicators are specific, measurable outcomes used to show competency in a given area and can be used as a guide for goals to reach (Morphew, 2012). Examples of performance indicators aligned with the goals of preparing students for college and career are the ISTE standards, which support the use of technology in education. ISTE is an organization whose sole purpose is to support effective learning

through proper use of technology in education. It its work, ISTE developed communities to establish standards to support teaching and learning through technology. ISTE is a trusted resource for professional development, knowledge generation, advocacy, and leadership for innovation to improve teaching, learning, and advancing the effective use of technology in pre-kindergarten through grade 12 and teacher education (Williamson & Redish, 2009). ISTE and the Center for Applied Research in Educational Technology (CARET) developed National Educational Technology Standards for Teachers (NETS) to guide and provide a level of professionalism and support when integrating technology into the learning environment.

Technology Models

Technological pedagogical content and knowledge framework. Mishra and Koehler (2008) put together a conceptual tool to assist teachers in planning lessons that integrate technology at a deeper level. The Technological Pedagogical Content and Knowledge (TPACK) framework provides greater depth of technology and its use with content and pedagogy, recognizing these areas are seamless in use to provide effective learning environments (Wetzel & Marshall, 2011). TPACK encompasses the understanding that arises from multiple interactions with content, pedagogy, and technological knowledge (Mishra & Koehler, 2008). The framework requires equal attention to technology, pedagogy, and content in designing curriculum (Mishra & Koehler, 2008). Additionally, TPACK is increasingly becoming a useful tool for researching technology integration in education (Mishra, Koehler, & Kereluik, 2009; Wetzel & Marshall, 2011).

SAMR model. Another conceptual tool helpful in clarifying teacher practices with technology integration is the SAMR model developed by Dr. Ruben Puentedura (2012), educational consultant who focuses on transformative applications of information technologies. Puentedura (2012) developed SAMR in the late 1980s to assist with the question of what types of technology are best to use for optimal student learning. SAMR stands for substitution, augmentation, modification, and redefinition. These words build off Blooms Taxonomy to strengthen learning to higher levels of thinking (Puentedura, 2012).

Curriculum developers and educators can utilize SAMR to verify if the lesson design provides the level of academic rigor they were aiming for in the content objective (Puentedura, 2012). The continuum of SAMR aligned and connected to the hierarchy of Bloom's Taxonomy, Webb's Depth of Knowledge, and Costa's Level of Questioning. All these models of thinking help guide educators in developing lessons to meet desired outcomes and guide what types of questions and activities to meet that goal (Schrock, 2013). SAMR is similar to these models and adds another level of depth incorporating technology in to the analysis of a lesson.

Levels of teaching innovation. Dr. Chris Moersh first conceptualized the Levels of Teaching Innovation (LoTi) framework in 1995. LoTi provides a tool for curriculum developers, teachers, and educators to align technology implementation that supports cognitively complex learning tasks (Moersh, 1995). The LoTi framework was field-tested throughout the United States, with several iterations. Currently the framework provides a fair approximation of teacher behaviors related to technology implementation based on review of classroom use and type of learning activity (Moersh,

1995). LoTi and the other frameworks provide examples of technology integration tools to support curriculum development with the use of technology.

Technology Integration in Middle School

As of 2009, Pew Research Center's Internet & American Life Project discovered 93% of American teens, ages 12 to 17, went online (Lenhart, Purcell, Smith, & Zickuhr, 2010). These data showed most students were online in one way or another. If being online is common place to adolescents, incorporating it in the learning environment will help keep students engaged, and engaged students apply themselves more resulting in deeper learning (Magna & Marzano, 2014). Engagement in learning is essential for knowledge acquisition and understanding (Casey, Giedd, & Thomas, 2000; Cennamo et al., 2014). This highlights why using technology such as the Internet, social media, web applications, and resources to engage students supports real-world learning experiences that connect to their lives resulting in deeper learning, retention, and application of knowledge (Harris, Mishra, & Koehler, 2009; Lenhart et al., 2010).

A study in 2008 asked 4,000 middle school students what they needed to be engaged and academically successful in school (Spires, Lee, Turner, & Johnson, 2008). The students reported using computers more in school and home and developing high levels of computer skills could help (Spires et al., 2008). The study also supported connecting to middle school student interests, although it did not detail what effective practice would look like in the middle school classroom.

Petty (2012) noted technology was a successful avenue to meet middle school student needs and help them be more engaged in cognitively complex tasks when used effectively. Technology integration was categorized into three main strands: (1)

interactive, (2) learning experiences and assessment, and (3) research and problem-solving. Petty (2012) found interactive applications provided learning activities that accommodated middle school needs by providing physical activity, creative expression, positive social interactions with adults and peers, frequent transitions, and social-based activities in a media-rich environment. Providing a digital learning environment encouraging active participation where students set, monitor, and manage their learning to meet their goals empowers adolescents to take ownership of their learning and progress (Dede, 2014; DiPetro, Ferdig, Black, Preston, 2008; Ertmer, 2005; Petty, 2012).

Digital resources that engaged and appealed to student developmental needs gave students a voice and choice (New Pedagogies for Deeper Learning Global Partnership, 2014). Students need to become contributing participants in the learning design as goals are set, which ensures learning outcomes are clear and processes involved to reach the goal are attainable and understood (Lenz & Kingston, 2016). Furthermore, interactive learning environments for effective technology integration need to sustain a climate and culture for learning through differentiated tools and strategies so access to curricula is available to all (New Pedagogies for Deeper Learning Global Partnership, 2014).

Educators today have the power to change the world in how they respond, implement, and integrate emerging technology. However, with the use of technology comes the resistance to change (DiPetro et al., 2008). Additionally, best practices are still being defined and although many resources exist, how to best utilize resources for effective technology integration in middle school remains unanswered (Godfrey, 2013;

Petty, 2012). Several different barriers may hinder effective technology integration and implementation of best practices.

Barriers Causing Ineffective Technology Integration

Over the past decade, with the massive penetration of technology into educational organizations, research findings as to the progress of supporting academic achievement were disappointing (Avidov-Ungar & Eshet-Alkalai, 2014; Hew & Brush, (2007). Avidov-Ungar and Eshet-Alkalai (2014) posited effectiveness of innovative technology integration into educational organizations was lacking due to key factors regarding pedagogical, cognitive, organizational, and affective challenges requiring paradigmatic changes in culture. Many factors contribute to ineffective technology integration, which range from attitudes, beliefs, institutional structures, scarcity of resources and funding, lack of skills, lack of time, lack of technical support, and limited knowledge (Boss, 2008; Ertmer, 1999; Hew & Brush, 2007). One barrier to effective technology integration is its lack of quality implementation (Fullan, 2013). Students need educators who effectively integrate technology with best practices and recognize the difference between technology taking over the classroom versus effective integration for deeper learning environments (Dede, 2014; Fullan, 2013).

The struggle of how and when to use technology are constant questions for educators. Fullan (2013) described the struggle, sharing:

> Figuring how to live and learn with gadgets is still a conundrum. This is part of an early stage in a new more radical improvement cycle. Amid the relentless proliferation of mobile devices is a new generation of teachers who are embracing the use of classroom technology. (p. 11)

However, Fullan (2013) suggested that unless effectively used to engage students and deepen learning in cognitively complex tasks, technology was ineffective. The goal is to understand how to organize the use of ever expanding technologies that match particular pedagogies, which requires evolutionary experimentation in what Fullan (2013) called the *sorting out processes*. One of the steps to help with the sorting out process is recognizing the work of technology and improvement of technology standards to support effective integrated learning environments (Fullan, 2013).

Barriers to providing access to technology exist due to lack of resources. The Leading Education by Advancing Digital (LEAD) Commission set forth to address and reverse the growing inequities regarding digital learning access between high- and low-income students and school districts (LEAD, 2012). Pew Internet & American Life Project reported many digital tools are widely used in the classroom, but teachers worry about inequity, creating digital divides when it came to student access to technology (Purcell, Heaps, Buchanan, & Friedrich, 2013). Teachers are concerned and face many obstacles when they bring technology to low-income students (Purcell et al., 2013). Comcast (n.d.) created the Internet Essentials initiative to break down barriers to digital literacy and affordability. The initiative allows industry leaders to collaborate with government officials to provide families of students who receive free school lunches with low cost Internet (Comcast, n.d.). The partnerships with Comcast helps further close the digital divide.

Another barrier is teacher belief in their own capacity. In research compiled by James (2009), teachers were categorized based on their beliefs, motivations, and practices. Teachers who believed using technology in the classroom benefited student

learning and fit well with curriculum overcame barriers and used technology regularly. However, teachers with a limited approach created a barrier in their own use based on their perception. Attitudes and beliefs influence the day-to-day decisions and choices of teachers regarding the integration of technology in the classroom (James, 2009). Despite barriers that influence the successful integration of technology (e.g., lack of funding, training, capacity, equipment), success still occurred (Fullan & Langworthy, 2014).

Statement of the Research Problem

Education continues to evolve to best prepare students to graduate from college and be career ready (P21, 2008). However, with the current educational environment, the public education system needs continued refinement to support the development of graduates ready for college and/or career (21st Century Workforce Commission, 2000). A nationwide survey of teachers and superintendents indicated the computer revolution had tremendous impact in the classroom (Brush, 1997). The focus of the study was the emphasis on student access to information outside the classroom and improved student motivation, not on specific academic achievement (Brush, 1997).

Placing computers and software in classrooms is not enough and discovering whether technology works in the classroom is not the primary point; the real concern is when and under what circumstances technology is effective for engaging and supporting deeper learning environments for student growth and understanding (Fullan, 2013). Like any other resource, teachers must come up with pedagogy, practices, strategies, and tools to make it work (Ertmer, 1999). Instructional technology holds a remarkable promise for changing the quality of teaching and learning in schools when effectively

applied (Earle, 2002; Ertmer, 1999). However, not enough is known about best practices to implement technology into middle school classrooms and the teacher skills necessary to be successful (Fullan & Langworthy, 2014; Hew & Brush, 2007). The research available regarding best practices in technology integration in middle school is still needed.

To meet the ever-expanding needs of students growing up as digital natives and provide them with skills to navigate the global world, teachers need innovative practices of their own (Fullan, 2013). Research was conducted regarding how perception impacted teacher technology integration (Boland & Oigara, 2008; Garthwait & Weller, 2005; James, 2009). James (2009) stated, "Pedagogy of educational technology is necessary before the field can join the current educational reform movement" (p. 143). Further research on what specific strategies, practices, and tools are effective in technology integration is needed (Horn & Staker, 2014; Javeri, & Persichitte, 2007). How and what is the best way to integrate technology in classrooms is still vague and complex.

Research Gap

Margaret Honey at the Education Development Center testified before the U.S. Senate that one could find ample empirical evidence that technology had a positive impact with the right conditions in place (Honey, Culp, & Carrigg, 2000). She concluded for technology to support real gains in educational outcomes, six factors must be in place: leadership, solid educational objectives, professional development, adequate technology resources, time, and evaluation (Honey et al., 2000). Additionally, Norris, Smolka, and Soloway (2000), in a convergent analysis of technology studies, identified

critical conditions as access to technology and time on task, adequate teacher preparation, effective curriculum, supportive school/district administration, and supportive family. Although extensive literature and research exist regarding technology integration, a gap was found regarding the combination of best practices and middle school integration.

Purpose Statement

The purpose of this mixed methods sequential explanatory study was to identify and describe best practices in technology integration in middle school classrooms as perceived by expert middle school teachers. Additionally, it was the purpose of the study to determine the most important best practices and perceived barriers to successful technology integration as perceived by expert middle school teachers.

Research Questions

1. What are the best practices in technology integration in middle school classrooms as perceived by expert middle school teachers?
2. What are the most important best practices in technology integration in middle school classrooms as identified by expert middle school teachers?
3. What are barriers to successful technology integration in middle school classrooms as perceived by expert middle school teachers?

Significance of the Problem

Schrum and Glasset (2006) stated education technology was widely available in schools due to large investments over the past two decades; however, the literature regarding best practices for implementation was limited. Technology is ubiquitous, touching almost every part of people's lives, communities, and homes. Yet most

schools lag far behind when it comes to integrating technology into classroom learning (Christensen, 2011; Edutopia, 2014). Many are just beginning to explore the true potential technology offers for teaching and learning (Christensen, 2009). Properly used, technology could help students acquire skills needed to survive in a complex, highly technological economy (Edutopia, 2014; Ito, 2013; Luckin, Bligh, Manches, Ainsworth, Crook, & Noss, 2012; Wenglinsky, 2005). Integrating technology into classroom instruction means more than teaching basic computer skills and software programs in a separate computer class (Edutopia, 2014: Ertmer, 2005).

Technology is part of the permanent landscape in classrooms with widespread implementation as significant practice continues to grow and evolve. Despite this phenomenon, little research is available regarding best practices for technology integration in middle school classrooms (Moeller & Reitzes, 2011). Some studies based on best practices and technology integration are available. However, there is a gap in the body of knowledge regarding best practices of technology integration used by middle school teachers. This study intended to fill the gap in research regarding best practice used by middle school teachers effective in technology integration.

Hargreaves and Fullan (2012) stated it was no longer enough to just highlight the top practitioners in the teaching field, but to learn from them and build the capacity of others. Hargreaves and Fullan (2012) called this the professional capital of the industry, wherein effective systems are developed to maximize student learning. The current research could assist middle school teachers to be more cognizant about how to purposefully and successfully integrate technology based on the understanding and best practices provided from expert practitioners in the field. It could also help identify how

expert technology integration teachers overcame barriers to implementation. This research may also be utilized by educational leaders to best support middle school educators in effective integration of technology. Middle school is a critical juncture when students experience early adolescence and unique developmental needs (social, emotional, and metacognitive). By embracing this unique space and researching best practices of technology integration for middle schools, the researcher could support teachers and impact the lives of middle school students.

Definitions

Definitions of terms referenced throughout this study are defined as follows:

Best practices. Existing practices that already possess a high level of widely agreed effectiveness (Hargreaves & Fullan, 2012).

Blended learning. Combining online learning with other methods of instruction (Barbour et al., 2011; Watson, Murin, Vashaw, Gemin, & Rapp, 2010). Blended learning is defined as any time a student learns in part from a supervised brick-and-mortar location away from home and in part through online delivery with some element of student control over time, place, path, and/or pace; often used synonymously with hybrid learning (Horn & Staker, 2011).

Digital learning. Any type of learning facilitated by technology (Watson et al., 2011).

Educational or instructional technology. Developing, using, and evaluating technology practices and resources to improve learning (Januszewski & Molenda, 2008).

Expert middle school teacher. An expert middle school teacher is someone teaching sixth, seventh, or eighth grades in a public school in California located within

the specified counties (Contra Costa, Marin, Napa, Sacramento, and Solano) who taught for at least three years integrating technology. Experts also had specific training or certifications in technology, held a leadership role in integrating technology, served as a lead teacher, authored or presented papers on technology integration, and were confirmed as an expert of technology integration by their principal or superintendent.

Online learning. Web-based instruction delivered by systems that include software and provide a structured learning environment. The instruction can take place over the Internet with the teacher and student separated geographically; used interchangeably with virtual learning, cyber learning, and e-learning. (Barbour et al., 2011; Watson et al., 2012).

Technology integration. The interweaving of technological resources seamlessly throughout the curriculum, not just occasional use (Molenda, 2008). Technology integration is the regular, daily use of digital devices (hardware and software) for instruction in the learning environment to achieve student-learning objectives and assess learning (Hew & Brush, 2007).

Technology tools (hardware and software). Tools used for instructional purposes including computer systems, CD/DVDs, scanners, projection devices, calculators, audio/video recorders, laptops, tablets, and digital devices (Rose, 2008). Software components include Internet applications, programs, online learning management systems, computer applications, and specialty programs (Heick, 204).

Delimitations

This study was delimited to expert middle school teachers in five counties within northern California. More specifically, the study was delimitated to include expert

middle school teachers who integrate technology in their classrooms and met the following criteria:

- Teaching sixth, seventh, or eighth grade in a public school located in California within the specified five counties (Contra Costa, Marin, Napa, Sacramento, and Solano)
- At least three years middle school experience teaching with technology
- Specific training or certifications in technology
- Leadership role in integrating technology; lead teacher, authored papers, or presented at workshop or conference on technology integration
- Confirmed as an expert of technology integration by their principal or superintendent

Organization of the Study

This study begins with an overview of the problem, its significance within public education specifically middle school classrooms, and the topic of best practices used by expert teachers of middle school classes. Chapter II reviews existing literature regarding the digital world and interconnectedness, and other relevant topics related to technology integration and education. Chapter III is presented the research design, population, sample, methods of data collection and analysis, limitations, validity and reliability of the study design, and ethical considerations. Research findings are presented in Chapter IV, including tables and narratives analyzing the findings of the study. Chapter five, includes a summary of the study and a discussion of the major findings, unexpected findings, and conclusions, as well as implications for actions, recommendations for further research, and concluding remarks and reflections of the researcher.

CHAPTER II: REVIEW OF THE LITERATURE

This chapter begins with a brief introduction to the topic studied and an explanation of major elements, variables, and subsections of research presented in the review of the literature. A synthesis matrix was created to help organize the literature studied and presented within this chapter (Appendix A).

Chapter II presents literature regarding globalization, history of education, history of technology integration, best practices for technology integration, middle school learners and their specific needs, technology best practices in middle school, and barriers preventing successful technology integration. The first section details global digital access and its effects on education in America's public-school system, highlighting the evolution of education and technology integration in the United States. The next section discusses middle school learners and their developmental needs. The third section focuses on information regarding technology integration best practices in schools and middle school technology best practices. The fourth section covers barriers influencing the use of technology in the learning environment.

Discovering, identifying, and clarifying best practices in technology integration are essential to continue effective classroom technology integration and support professional development programs. Technology integration is still in its infancy stages and the need to identify best practices in middle school is essential (Pacansky-Brock, 2013). The purpose of this mixed methods sequential explanatory study was to identify and describe best practices in technology integration in middle schools as perceived by expert middle school teachers. Additionally, it was the purpose of this study to

determine the most important best practices and barriers to successful technology integration as perceived by expert middle school teachers.

Globalization

Information technology availability and ease of use provide interactions between people and organizations of differing nations like never before (Fullan, 2013; Wood, 2008). The digital revolution is taking over the world and transforming work and daily lives. Globalization continues to drive international economies, influence interactions across the world, and impact structures, practices, and educational programs. Wood (2008) defined globalization in an enlightening way using the analogy of the force from the movie *Star Wars*. Wood (2008) explained globalization was like the force because it is, "omnipresent, surrounding us and penetrating our institutions…with an energy field of sorts, with an uncertain agency that binds the countries of the world together, enthusiastically and reluctantly" (pp. 36-37).

Thomas Freidman (2005) in his book *The World is Flat* contended the confluence of events flattened the world in a unified global community, knitting most nations together and leveling the playing field of global competitiveness. Freidman (2005) emphasized the need to prepare individuals to develop skills to navigate the global world, utilize new technologies, maintain a growth mindset, adapt, participate, contribute, and collaborate in a knowledge industry. However, globalization has its down side in that it produces inequities and widens disparity between the *haves* and *have nots* (Wood, 2008). An example of this is developed versus undeveloped nations; undeveloped nations cannot even access the playing field and do not benefit from the global capital of the knowledge economy, free trade, and inexpensive labor (Ghemawat,

2007). Whether globalization benefits a nation is dependent on the processes affecting everyone in the world and requires an innovative approach regarding educational purposes (Ghemawat, 2007).

Globalization and Education

The 20th century differed in the skill set needed to find a job or go to college (Freidman & Mandelbaum, 2011). In the 20th century, people remained at the same job most of their adult life (Fullan & Langworthy, 2014). Many had the same position with the same company until they retired (Friedman & Mandelbaum, 2011; Partnership for 21st Century Learning [P21], 2011). With the combination of globalization and information technology, the world evolved into a global economy driven by innovative industries, services, products, markets, and politics (Friedman & Mandelbaum, 2011; Mahunik, 2014). These changes resulted in an employment poor society where the market expects more for less; more products and service for less money, resulting in fewer jobs (Friedman & Mandelbaum, 2011; P21, 2011). "The need for different societies to compete in a world where knowledge is a principle currency has turned the organization and purpose of education systems into key factors for relative competitiveness" (Welmond, 2002, p. 39). The change drivers of technology opening a global society are pervasive, causing change in education. Fullan and Langworthy (2014) explained this phenomenon as shown in Figure 1.

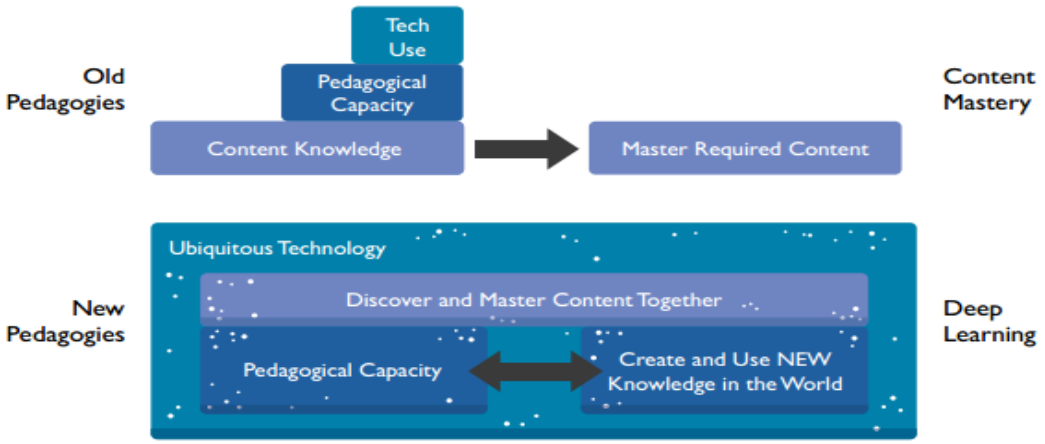


Figure 1. How New Pedagogies are Different. Source: Fullan and Langworthy (2014).

P21 (2011) came into existence in 2002, consisting of various technology corporations, organizations, and public and private members who value the nation's workforce and saw the need to guide education to develop college- and career-ready students. Collaborative partnerships between leaders in education, business, communities, industry, and government comprise this organization (P21, 2011). Examples of key partners include Microsoft, National Education Association, Apple, Cisco Systems, ISTE, State Educational Technology Directors Association (SETDA), and USDE. P21 and its members provide tools and resources to help the United States education system clarify essential skills students need to be successful in college, career, and life (P21, 2011). These partnerships created P21, providing the information of what skill development is needed based on the global economy taking hold of the world today and the need to change how and what is taught to today's generation of students.

In this modern time, companies look for employees who demonstrate they are critical thinkers, effective collaborators, creative innovators, and articulate communicators (Friedman & Mandelbaum, 2011; P21, 2008; Petersen, 2010). P21

refers to a specific set of competencies as a 21st century skill and stresses how 21st century skills are an essential requirement for students to succeed (Petersen, 2010). These competencies include mastery in core subjects and 21st century learning themes, media and technology literacy, learning and innovations skills, and life and career skills (P21, 2008).

The framework developed by P21 (2011) contains six elements for 21st century skills and learning. This framework describes what 21st century students need to be successful in college, career, and life. Five elements of student outcomes identified by P21 (2011) were:

- Mastery of Core Subjects
- 21st Century Content
- Learning and Critical Thinking Skills
- Information and Communication Technology (ICT) Literacy
- Life and Career Skills

Employment sectors today are searching for individuals who can navigate information and communication systems, while collaborating, problem solving, being creative, and are innovative contributors to the organizations in which they work (Friedman & Mandelbaum, 2011). Evidence supporting this can be found in cooperative partnerships. For example, Cisco, Intel, and Microsoft collaborated to form Partners in Education Transformation, which discovered the countries with the largest economies have economic yield in innovation and production of information products. This information drives the educational policies needed to provide students with a curriculum

that supports 21st century skill development integrated with technology (Friedman & Mandelbaum, 2011; Velez, 2012).

Evolution of Education

The work of schools is demanding. The United States inherited the factory model of education from the Industrial Age when schools were about training factory workers en masse (Friedman & Mandelbaum, 2011; Goleman & Senge, 2014). To maximize human potential and develop higher levels of learning and skills, today's educational application needs to include cultivating student innate potential. Additionally, schools need to focus on growing human beings while building student capacity. This would result in outcomes where students are learning how to think in ways that provide diverse 21st century skill development to meet ever-changing global workforce needs and be employable or able to move on to the next level of education (Goleman & Senge, 2014; Mahunik, 2014). The challenge of improving quality instruction with emerging technologies creates a new paradigm of teaching not solely based on acquired knowledge (Goleman & Senge, 2014; Mahunik, 2014). Education evolved over the years from the Industrial Age to the Global Age.

What Happened in Education Over the Past Twenty Years

Thirty-five years ago, the National Commission of Excellence in Education (1983) informed policymakers of the quality of education of students in the United States in their report, *A Nation at Risk*. Findings from this report indicated student achievement scores were declining and far below the achievement levels of other countries. American students were not developing higher order thinking skills or meeting the demands needed for the workforce (National Commission on Excellence in

Education, 1983). Educational leaders took this report seriously and a call to action emerged.

Another recommendation stemming from the 1983 report was the development of standards (National Commission of Excellence in Education, 1983). *A Nation at Risk* reported two goals: (1) students in grades 4, 8, and 12 demonstrate proficiency in English, mathematics, science, history, and geography by 2000; and (2) students were to be first in the world's achievement scores in math and science by 2000. To determine criteria and compliance toward achievement of these goals, standards were needed in content areas (National Commission of Excellence in Education, 1983).

Thus, the standards movement in education evolved and now impacts curriculum designed, teaching, and learning. Prior to 1983, there was little discourse of standards in education in the United States (Cennamo et al., 2014; Wenglinsky, 2005; Wong, 2012). Efforts by national professional organizations in major content areas began to create curricular standards for specific disciplines (Cennamo et al., 2014; Wenglinsky, 2005; Wong, 2012). Standards define knowledge and skills students should gain during kindergarten through 12th grade to graduate high school able to succeed in entry-level college or career (Fletcher, Schaffhauser, & Levin, 2012). Additionally, standards ensure parents and teachers have a common understanding of what students are expected to learn and provide benchmarks for all students (SETDA, 2012).

Research reported a growing achievement gap of low-income and minority students. No Child Left Behind (NCLB), enacted in 2001, was created to provide accountability measures in the public school system. This was an attempt to require consistent use of standards throughout the nation. Under NCLB, states were required to

administer assessments to measure student performance; these accountability measures were to ensure federal funds were used as intended (W. Hayes, 2004; Peterson, 2010). NCLB's premise was to promote equity in education and support disadvantaged groups (W. Hayes, 2004). Conversely, the need for students to meet growth targets put emphasis on teaching to the test instead of critical thinking skills (Wagner, 2008).

However, employers and colleges continued to report students were ill-prepared for college and career (P21, 2008). The global workforce thrives on a knowledge-based service economy where workers need technology skills that include proficiencies in communications, creativity, information literacy, collaboration, and problem-solving (Friedman & Mandelbaum, 2011; Goleman & Senge, 2014; Mahunik, 2014; P21, 2011). The growing emergence of a knowledge-based society generates an increasing need for learning, creativity, and innovation (P21, 2011; Goleman & Senge, 2014; Wagner, 2008).

Today's Educational Environment

America's public schools consistently increased in student population over the past decade (USDE, 2010). However, fundamentally little else changed (Fullan & Langworthy, 2014). Constructs remained fixed grades, rigid curricula, and teachers as the focus of the classroom and distributor of knowledge (Fullan, 2013; Goleman & Senge, 2014). America's public schools are tasked to educate increased numbers diverse students who come with a host of other challenges such as (a) persistent poverty, (b) changing family patterns, (c) inadequate community supports, (d) limited access to technology, (e) limited English proficiency, and (f) safety concerns (Darling-Hammond, 2010).

Integrating technology in the classroom is creating innovations for teaching and learning at a time when the nation is struggling to yield a productive, skilled workforce to compete in a rapidly changing global community (Darling-Hammond, 2010). The federal, state, and local budget deficits with uncertain funding challenge the educational system (Darling-Hammond, 2010). These obstacles stimulate education technology policies to support development of an innovative and effective public education system to provide students with the skills to compete in the 21st century global economy (Darling-Hammond, 2010; Wenglinski, 2005).

Education is shifting paradigms to new understandings of how people learn, think, and think about learning, curriculum, and development of knowledge. New technologies are leading the way to new teaching and learning in public schools (Christensen, Horn, & Staker, 2013; Goleman & Senge, 2014; Mahunik, 2014). Education changed significantly over the years. Where technology is used, research findings on learner outcomes are vague with the need to clarify technology and its purposeful use (Fullan & Langworthy, 2014).

Technology Integration in Education

History of Technology Integration in U.S. Education

Technological advances brought about innumerable aspects in design and new methods in education (Becker, 2001). The use of technology in the classroom changed significantly over the past few decades with its beginning circa 1960 (Becker, 2001). Regarding hardware, the public education system went from no computers, to one computer in an entire school, to computer labs, and evolving recently to a one-to-one student to computer ratio (Becker, 2001). The first computer, possibly an Apple

computer, was used entirely for simple functions with limited student access, restricted capacity, and minimal use (Dawson, 2010; Staples, Pugach, Himes, 2005; Windschitl & Sahl, 2002). The boom of the educational technology integration movement grew based on the availability, Internet access, and more powerful computers (Chung, 2007).

One example of software application use with students is from a Massachusetts Institute of Technology professor, Seymour Papert, who was among the first to see the potential of technology in the learning environment (Boss, 2011). In the 1960s Papert and Jean Piaget, world-renowned Swiss psychologists, collaborated to develop a computer programming language for students to engage in developing computer code and write their own programs to understand mathematical concepts (Boss, 2011). Since Papert's work, computer applications and tools became widespread. Educational technology integration movements in the 1990s had momentum, but policies to match this momentum needed to be put in place to sustain meaningful, relevant use (Cuban, 2004; Ferending, 2003). Over the last two decades, the use of Internet and personal computers in the classroom became commonplace (Chung, 2007). As with any new concepts and/or tools, the concern regarding whether the integration of technology is superficial comes to play (Cuban, 1993). Determining effectiveness along with policies and practices to support technology integration is essential to sustain long-term growth and meaningful learning. Policies to support effective use are emerging at a slow pace and not progressing as quickly as students need (Becker, 2001; Cuban, Kirkpatrick, & Peck, 2001).

Currently, computers and personal digital devices are used daily in the classroom (Dawson, 2010). The educational challenge is how to best utilize effective teaching

practices along with technology implementation strategies for enhanced student learning environments (Dawson, 2010; Ertmer, 1999; Luckin et al., 2012;). Mansilla and Gardner (2009), theorists of multiple intelligences, stated the current challenge in transforming educational policy as,

> So long as we insist on teaching all students the same subjects in the same way progress will be incremental. But now for the first time it is possible to individualize education - to teach each person what he or she needs and wants to know in ways that are most comfortable and most efficient. (p. 97)

This statement leads to further questions as to the subjects and skills needed for 21st century learners to succeed in the future and how teachers effectively provide differentiated, individualized education utilizing technology. Clay Christensen (2011), Harvard Business School professor and disruptive innovation expert, described disruptive innovation as a process by which a product or service opens the door to non-traditional changes to improve a system. In this book *Disrupting Class*, Christensen (2011) described how education needs an immediate, abrupt infusion of technology in public education to disrupt the system and improve learning. This disruptive innovation supports how with technology, a new pedagogy is needed that incorporates technology and supports effective learning and skill development useful in the 21st century (Christensen, 2011; Fullan & Langworthy, 2014). Before addressing effective teaching practices in technology integration, the next section discusses middle school history and its origins.

Middle School History

The origins of U.S. educational grouping by developmental needs led to the categorization into specific grade levels; elementary was distributed over eight years and high school distributed into four levels (Yecke, 2005). Middle school philosophy found its beginning in the early 1900s with the first intermediate school constructed about 1895; however conservative researchers suggested these schools called in-between schools first surfaced in the education history of the United States closer to the 1910s (Gloer, 2007). Harvard President Charles W. Eliot (1916) believed students needed to be prepared for college at a younger age, and he fueled the push to separate older elementary school students into their own building. The starting of preparation for college at a younger age combined with the population boom resulting from the end of World War I were the catalysts to encourage administrative processes supporting older elementary students to have their own buildings (Brookfield, 1995; Wavering, 1995). Although the foundation of middle level education's purpose was to improve secondary education, the face of middle level education changed radically over time (Alexander & McEwin, 1989; Standish, 2008).

Initially, middle level education was configured with some variation across the nation; school configurations included 6-8. 7-8, and 7-9, with some schools more recently serving 5-8 in middle school. Research studies performed to evaluate middle school effectiveness resulted in the need to bring about changes due to curriculum not meeting age-specific developmental needs (Pardini, 2002; Weiss & Kipnes, 2006). Historically, placement in classes caused students to be tracked (a practice of grouping students of similar levels to develop together), resulting in students feeling disconnected

and harboring false feelings of inability and often resulting in a lack of love for learning (Standish, 2008; Wavering, 1995). Conversations for change were based on figuring out how to make middle level education more developmentally appropriate and responsive to adolescent needs (Anfara, Andrews, & Mertens, 2005; Martens, Anfara, & Caskey, 2007; Standish, 2008).

Early 1960s reform efforts led by John H. Lounsbury, considered one of the founders of the middle school movement, led to a to change in middle level education to support adolescent needs and eliminate the tracking of students (Standish, 2008). This push was to change middle level education from a holding place for students growing through adolescence to the movement of building middle schools for young people ages 10 to 14 (Lounsbury, 1960; Meyer, 2011; Nagel, 2010). Reorganization of education included middle school, also known as junior high, started with two years leading to the door of high school (Lounsbury, 1960; Meyer, 2011). At that time, college prep and a holding place for adolescents was the expressed purpose (Lounsbury, 1960). In Dr. William Alexander's (renowned curriculum authority) speech at Cornell University in 1963 regarding the future of middle level schools, he spoke to the importance of educating the whole child and the unique developmental needs of young adolescents.

Since then, curriculum development reform efforts led to pedagogically rich, full experiential learning environments where experimentation became the norm for middle level education (Drolet & Arcand, 2012). Middle school continued to evolve since the 1960s and success in academic arenas are proving middle schools are remarkable academic institutions supporting the overall wellbeing of students resulting in positive outcomes when focused on specific evidenced-based practices (Drolet & Arcand, 2012;

EdSource, 2010; Meyer, 2011, Piaget, 1952, 1960). However, more education trends show concern in grade configurations (Meyer, 2011).

Researchers from the Columbia Business School concluded the stand alone sixth through eighth grade middle school configuration may not be the best way to educate students (Rockoff & Lockwood, 2010). Rockoff and Lockwood (2010) found schools with kindergarten through eighth (K-8) grade better supported student development. This research showed how grade configuration could lead to different outcomes when students stay on a site from kindergarten through eighth grade versus the stand-alone middle school model (Rockoff & Lockwood, 2010). Researchers argued students in middle school still need the elementary like nurturing environment that provides students with a caring, loving adult (Meyer, 2011). Meyer (2011) purported when the grade configuration led to a stand-alone middle school, the elementary nurturing learning environment that students still needed was no longer as prevalent.

A report written by Fester (1987) called *Caught in the Middle: Educational Reform for Young Adolescents in California Public Schools*, details evidence regarding what makes the most effective environment for middle school students. Fester's research provided more insight into meeting the needs of middle school students in an intellectually captivating learning environment irrespective of whether it is K-8 or a stand-alone middle school. After a year of research, Fester (1987) determined effective middle school instruction emphasized emotional connections, academic integrity, academic rigor, support, and togetherness.

Developmentally Unique Middle School Students

Early adolescents are developmentally unique (Piaget, 1952, 1960). Middle level education needs to support the unique developmental needs of adolescents. This section clarifies and explains what makes the middle school student unique.

Child development theorists describe the ages of individuals from 11-18 years old as adolescence, a time where growth of strength, cognitive competencies, and sense of purpose are formed; middle school focuses on the developmental needs of youths in early adolescences aged 10-14 (Lee & Smith, 1995). Through the developmental process, students grow intellectually, biologically, physiologically, emotionally, socially, and academically (Lee & Smith, 1993). These areas of growth for a middle school student can surface as conflicts that resemble existential concerns (Fitzgerald, 2005). These existential concerns are why early adolescents need environments that explain the developmental growth; they need explicit explanations of what they are going through and how it is normal. Moreover, adolescent students need adults in their lives consistently affirming who they are and reassuring them the developmental stage is not who they are, but a phase in their growth. Understanding adolescent development benefits all the people working with adolescents; it ensures developmentally appropriate curriculum design that promotes positive learning environments (Fitzgerald, 2005).

Young early adolescents experience extreme intellectual development and social experiences with pervasive risk-taking adventures, and the evolution of a myriad of physical changes (Fitzgerald, 2005). Beginning stages of adolescents generally begin between ages 10-13 (Fitzgerald, 2005). Unpredictable, varied physical changes and

rapid brain growth take place during the ages of 10-12 that seem to even out between the ages of 12-14 (Brooks-Gunn, Petersen, & Eichorn, 1985; Fitzgerald, 2005).

Growth spurts bring on skeletal and muscular system changes (Knowles & Brown, 2000). Bones are growing faster than muscles, bringing about short-term coordination issues (Kellough & Kellough, 2008; Raphael & Burke, 2012; Roney, 2005). Significant increases in weight, height, and sizes of internal organs occur during adolescence (Roney, 2015). Growing pains result when muscles and tendons are not protecting bones due to the growth spurts (Wiles, Bondi, Wiles, 2006). Youth experience restlessness, weariness, and lack of energy based on fluctuations in their metabolism (Kellough & Kellough, 2008).

Researchers reported significant changes within the brain of young adolescents where synapses restructure the neural wiring in the prefrontal cortex (Casey et al., 2000; Dahl, 2004). This is the area of the brain where decision-making, planning, reasoning, thinking about consequences, and attention over extended periods rapidly develops (Brown & Knowles, 2014; Nagel, 2010). The Carnegie Council on Adolescent Development stated for adolescents to make a successful transition to adulthood, they must master many factors (Russell, 1996). Adolescents struggle with social interactions and are learning to master social skills and the ability to manage conflict (Caissy, 2002). Their brain continues to develop from concrete to abstract thinking, cultivating inquiry and problem-solving habits of mind for lifelong learning (Caskey & Ruben, 2007; Russell, 1996). This is when skill development grows and they need to acquire technical and analytic skills to navigate their world (Brown & Knowles, 2014; Dahl, 2004; Russel, 1996). Reasoning skills develop to help them become ethical people and learn the

requirements of responsible citizenship and how to respect diversity; these are essential areas of needed guidance (Brown & Knowles, 2014; Caskey & Anfara, 2014; Caskey & Ruben, 2007; Russell, 1996).

Moral development deals with an individual's ability to make wise choices and learn productive ways to interact with others (Modgil, Mogil, & Brown, 2013). During adolescences, the beliefs, attitudes, and values formulated tend to stay with people throughout their lives (Brighton, 2007). Young adolescents are in search for their identity, whether it be social, sexual, gender, ethnic, cultural, familial, socioeconomic, or spiritual, which all relate to who they are and who they want to become (Brown & Knowles, 2014). This constant search of their own person may lead to times of confusion wherein they need supportive adults to help them work through their concerns while guiding them through their own development of healthy processing and development of healthy relationships (Brown & Knowles, 2014; Roehlkepartain, Benson, King & Wagener, 2006).

A longitudinal study by Véronneau and Dishion (2010) explored the importance of friendships on academic achievement. Véronneau and Dishion (2010) eloquently explained how friendships mattered to middle school students, sharing, "Early adolescence is a time of important social transitions, including changes in relationships with parents and movement toward the peer group" (p. 99). Friendships were important and understanding physiological, biological, and intellectual changes of middle school students (Donnelly, 2015). Boys and girls go through puberty and experience new sensations that if not mentored through the processes can bring about undue fear and anxiety (Brown & Knowles, 2014; Donnelly, 2015; Raphael & Burke, 2012; Roney,

2005). Psychologically, changing from a concrete to more abstract thinker comes into play (Brown & Knowles, 2014; Donnelly, 2015). This may lead to early adolescents participating in risk-taking with extreme detrimental consequences. Adults understanding adolescents encourage healthy risk-taking behaviors allowing for genuine cognitive growth (Brown & Knowles. 2014).

Research indicated adolescents represents a unique developmental age with specific learning (National Middle School Association [NMSA], 2010). NMSA (2010) supported seven developmental needs of early adolescents:

1. Positive social interaction with adults and peers
2. Structure and clear limits with physical activity
3. Creative expression
4. Competence and achievement
5. Meaningful participation in families and school
6. Community opportunities for self-definition
7. Opportunities for success, respect, movement, and fairness

A successful middle school curriculum provides a combination of a well-balanced, developmentally appropriate, academically challenging, and stimulating learning environment that empowers learners and promotes healthy self-images, relationships, morals, and physical development (NMSA, 2003).

Glick (2014) emphasized the importance of cultivating student aptitude to think creatively and critically by developing the qualities of connection, purpose, and mastery. Glick (2014) further explained how brain research explained plasticity helps in the development of thinking. Plasticity is the ability to change with experiences and

develop through growth in patterns (Glick, 2014). This information helps teachers know through development of patterns, neural networks form that assist in the development of critical thinking, creativity, communication, collaboration, and empathy (Glick, 2014; Velez, 2012). Additionally, to support academic learning, middle school students need to feel safe (Glick, 2014). Brain research found emotions impact learning; therefore, if students feel connected and safe in a learning environment they can think in more productive ways (Glick, 2014; Velez, 2012; Wiles et al., 2006). Teachers develop thinking by providing safe learning environments along with developmentally appropriate, challenging content to support success for middle school learners (Velez, 2012). This type of learning environment provides safe space to take risks in conjunction with engaging, purposeful skill development to provide the structures necessary for middle schoolers to thrive (Glick, 2014; Stevenson, 2002; Thornburg, 1983; Wiles et al., 2006).

Middle School Population: A Unique Generation of Digital Natives

Another factor to consider is the new generation in schools. The face of this upcoming generation is different from ever before (Ito et al., 2008). Advancements in information, communications, and technology changed how they grew up (Buckingham, 2007; Ito, 2013; Velez, 2012). More and more homes own multiple televisions, computers, and cell phones (Ito et al., 2008). Instant access to information, products, and each other changed how people connect and create new knowledge (Ito et al., 2008). Different forms of social media, electronic mail, videos, blogs, texts, gaming, and electronic sources are now used to communicate with family, friends, co-workers, communities, and others through the Internet (Buckingham, 2007; Ito, 2013). This

continuous access to the Internet altered society and economics (Internet World Stats, 2015; U.S. Department of Commerce Economics and Statistics Administration [ESA], 2011). More than 68% of households use broadband Internet access service and 80% of households have at least one Internet user either at home or elsewhere (ESA, 2011). ESA (2011) reported over 77% of American households had at least one computer at home, if not more digital devices, which seemed to be one of the leading causes of adolescents growing up surrounded by digital innovations.

The largest age groups to use technology (e.g., computers, mobile devices, Internet) are children and teenagers (ESA, 2011). Ninety percent of children (approximately 48 million) between the ages of 5 and 17 use computers, compared to 65% of 10-13-year-olds and 75% of children between the ages of 14-18 (ESA, 2002). Children born from 2000 through 2012 are known as post-millennial children being raised in a truly digital society; they are the most racially and culturally diverse group in United States history and may be the most transient due to advances in global communications (Pacansky-Brock, 2013). Technology is pervasive; recognizing and including this in making education relevant to students is essential for preparing them for the future (Pacansky-Brock, 2013). Identifying best practices effective for middle school technology integrated classrooms is a necessity (Simmons & Blythe, 2008; Strahan, et al., 2009; Tanner, 1973).

Technology Integration Best Practices

Best practices refer to existing practices already possessing a high level of widely agreed effectiveness (Hargreaves & Fullan, 2012). With the rapid global trends and use of technology, few best practices appear in research. Actual best practices were

organically created through the struggles and learning between the teacher and students as they worked together to be successful in this new era of digital ubiquities (Fullan & Langworthy, 2014).

Research described technology integration as "using technology including computers, digital cameras, compact disks, held devices, probes and related technologies to deliver and enhance the curriculum already in place" (Pitler & Bartley, 2004, p. 1). Petty (2012) stated governmental mandates and district policies placed it in the teachers' hands to develop learner-centered classrooms integrating technology, which placed them in a conundrum of how to integrate technology tools in the classroom effectively. Technology integration can be perceived in many ways. To harness the technology rampage and place parameters for effective learning, technology committees such as ISTE worked together to develop standards and tools to guide educators. ISTE attempts to support the effective use of technology as it rapidly evolves toward the goal of effective technology use resulting in deeper learning.

Moreover, research stated technology integration best practices need to yield high-quality learning, as suggested by Ahlberg, Turja, and Robinson (2003). The digital learning environment is meaningful such that learning outcomes are connected to earlier knowledge and corresponds to the real needs of individuals, society, and humankind (Magana & Marzano, 2014). Learning in context needs to provide deep justifications for knowledge, a purposeful reason as to why the content is important, and consequences of knowledge tested both theoretically and empirically (Cennamo et al., 2014). Research implied technology integration best practices should promote transformative learning experiences that surpass earlier knowledge, where expertise and

knowledge can be used to solve real problems by reframing them and seeing them from different perspectives (Cennamo et al., 2014; Fullan & Donnelly, 2013; Luckin et al., 2012; Magana & Marzano, 2014). Additionally, students need to be informed as to the metacognitive processes that provide ways of monitoring and promoting one's own learning and analyses (Cennamo et al., 2014; Magana & Marzano, 2014).

Review of the literature suggested the following technology integration strategies support high-quality learning environments: (a) clear learning objectives and goal setting, (b) scaffolded instruction, (c) realistic learning contexts and real-world application, (d) multiple perspectives, (e) differentiation that addresses multiple learning styles, (f) visual and hands-on learning experiences, (g) guided practice, (h) checks for understanding, (i) cooperative learning, (j) think-pair-share, (k) summarization, (l) peer tutoring, (m) student discussions, (n) student voice and choice, (o) alternative assessment, and (p) student-centered inquiry (Alber, 2017; Cennamo et al., 2014; Fullan & Donnelly, 2013; Magana & Marzano, 2014; McDowell, 2017).

Student-centered problem- or project-based learning. McDowell (2017) defined project-based learning (PBL) as a "series of complex tasked that include planning and designing, problem-solving, decision making, creating artifacts, and communicating results" (p. 2). PBL provides student-centered learning, small group work, authentic problems presented as questions, and new information acquired through supports guiding self-directed learning (McDowell, 2017). Chard (1998) stated a major advantage of PBL was that it made school more like real life, providing opportunities to question the issue and connect with resources in the field. PBL with technology provides a vehicle to access unlimited resources opening the world to the students (Boss,

2011). Integration between project-based learning and digital innovations when done well can replace and improve ineffective instructional practices with no impact on learning while providing engaging learning environments where students apply knowledge and deepen their understanding (Lenz & Kingston, 2016).

Clear learning objectives. Technology integrated classrooms support clarifying what learners should understand and achieve through specific activities (Killen, 2007). Ongoing feedback can be provided through computer applications and shared documents to guide learning (Boss, 2013). This approach can be done through an entry event that introduces the concept, questioning or describing what learners are to understand, and connections to prior knowledge or personal background (Boss, 2013; Dessoff, 2012; Killen, 2007). Making connections to previously learned knowledge through review, feedback, and practice helps ensure student understanding (Dessoff, 2012). Upon discussing learning objectives, student collaboration and writing out their goals for the day promotes active student engagement, ownership of learning, and self-directed student inquiry while practicing skill development and content understanding (Boss, 2013; Merrill, 2007). These processes can be delivered through a learning management system to keep track of tasks (Magana & Marzano, 2014).

Hattie (2012) described visible teaching and learning, meaning when teachers make clear students know what they need to do and how. Visible teaching and learning can be attained when the learning objective is challenging yet unambiguous (Hattie, 2012). This same principle of visible teaching and learning needs to be present in the classroom consistently during technology integration (Fullan & Langworthy, 2013; Hattie, 2012).

Authenticity. Creating real-world applications is a best practice to support student learning that is relevant and of student interest, which supports connections that relate to the students' world (Killen, 2007; Taylor, 2014; Tileston, 2011). Encouraging creativity, connections to learning, and reflective thinking promote respectful learning where all students thrive (Tileston, 2011). Providing learning interactions that mirror a real-life situation endorses authentic realistic, learning (Killen, 2007; Taylor, 2014; Tileston, 2011).

Scaffolding, differentiating strategies, and adapting teaching. Effective learning is facilitated by an active learning environment making connections to prior knowledge (Merrill, 2007). Content appropriate to assist student learning along with a suitable learning activity provides relevant experiences to build a foundation of new knowledge (Killen, 2007; Rosenshine, 2012). To help build understanding, a technique often utilized is scaffolding (Rosenshine, 2012). Scaffolding provides learners with just enough help to complete a learning activity, wherein help is gradually decreased as the student becomes independent (Killen, 2007). Learners demonstrating new knowledge build new synapses for more information and experiences to take root, resulting in portrayals or representations that can be applied to specific situations (Killen, 2007; Merrill, 2007; Rosenshine, 2012). Providing learning opportunities for students to analyze multiple resources supports constructivist theories (Killen, 2007). Teachers organize learning and instruction around important ideas, provide primary sources, and ask questions that provoke thought and student inquiry (Cañas, Reiska, Ahlberg, & Novak, 2003; Killen, 2000).

Multiple learning styles. Gardner (1999) provided research identifying several distinct intelligences. According to his theory, individuals learn through different ways albeit language, logical-mathematical analysis, spatial representation, musical thinking, kinesthetics, auditorily, or visually. Individuals differ in the strength of their intelligences and tend to carry out different tasks, solve diverse problems, and progress in various domains in different ways (Gardner, 1999). These intelligences need to be consider when designing learning activities to meet student needs (Tileston, 2004). Strategies for differentiating learning experiences include many similar techniques appropriate for all learners (Tileston, 2004). These strategies comprise using visuals, hands-on learning experiences, peer tutoring, music, oral activities, group discussions, Socratic seminars, explicit modeling, direct instruction, cooperative learning, nonlinguistic organizers (e.g., graphic organizers, concept maps), flexible learning environments, sensory learning experiences, manipulatives, and discovery activities (Gardener, 1999; Rosenshine, 2012; Tileston, 2004).

Visuals. The use of visuals such as pictures, artifacts, media, or videos to provide clarity and understanding when introducing new concepts is an exceptionally effective teaching strategy (Allison & Rehm, 2007). Visuals can be used in any content area and through various sources of instructional tools (Allison & Rehm, 2007). Carrier (2005) provided examples of visuals used to provide mental images, such as pictures, cartoons, maps, graphs, charts, diagrams, videos, drawings, graphic organizers, storyboards, photographs, posters, and alternative formats of multi-media formats and applications. Middle school teachers can integrate visuals into any learning experience through myriad supports and scaffolds, including concept maps, graphic organizers,

online web applications for brainstorming, mind maps, short answer prompts, and student made flash cards (Allison & Rehm, 2007; Cañas et al., 2003; Carrier, 2005). Other strategies include models, puzzles, 3D modeling, video conferencing, television, multimedia, charts, and graphs (Gardener, 1999).

Hands-on-learning experiences. Hands-on learning provides opportunities for movement in the classroom, interaction with supplies and materials, and manipulation of equipment and objects, which result in more meaningful learning (Allison & Rehm, 2007: Tileston, 2004). Simulations provide hands-on learning experiences (Tileston, 2004). Simulations offer practice with real-world applications in a safe learning environment (Allison & Rehm, 2007). Other types of hands-on strategies are role-playing, educational games, laboratory experiments, use of equipment and real objects, and use of the body through physical activities (Allison & Rehm, 2007). Group techniques and cooperative learning are also experiential, learner-centered activities.

Inquiry based, student-centered learning. Inquiry-based learning is a pedagogical approach used to meet the needs of 21st century learners, allowing technology to be integrated authentically within the classroom (Anderson & Dexter, 2003; Sutherland & Joubert, 2009). The idea of teaching students how to learn so their thinking can be functional for a wide-ranging scope of future endeavors engendered weighty attention from educators looking to make learning more authentic (Morrison & Lowther, 2010; Sharples & Anastopoulou 2012). Inquiry-based, student-centered learning design is to empower the learner through a personalized educational experience (Buckner & Kim, 2013; Morphew, 2012).

Digital learning activities that support inquiry-based, student-centered learning include brainstorming ideas (e.g., padlet, learning management systems, Google docs), resources to support multiple perspectives and guide next steps (e.g., TedTalks, Podcasts, Kahn Academy, teacher made videos or podcasts), and presentation applications to show what was learned (e.g., Prezi, Infographic, YouTube). Accessible technology through the Internet provides a bounty of options to support and guide inquiry-based, student-centered learning (Rosenshine, 2012; Wetzel & Marshall, 2011).

Adaptive teaching/guided practice. Presenting new information in small steps with student practice, daily review, helpful feedback, and student presentations were more strategies that assisted student understanding (Merrill, 2007; Rosenshine, 2007). Designing thinking activities and modeling how to think through the learning activity, followed by student practice is essential in enhancing student understanding and use of knowledge (Hattie, 2012; Marzano, Pickering, & Pollock, 2001; McDowell, 2016). Rosenshine (2007) stated,

> Another reason for the importance of teaching in small steps, guiding practice, and checking for understanding…comes from the fact that we all construct and reconstruct knowledge as we learn and use what we have learned. We cannot simply repeat what we hear word for word. Rather, we connect our understanding of the new information to our existing concepts or "schema" and we then construct a mental summary. (p. 17)

Checking for understanding allows teachers to add to existing schemas to develop clear construction or clarify misconceptions (Rosenshine, 2012). Technology

integration supports ongoing check-ins through collaborative work that can be completed through computer applications (Marzano et al., 2001).

Checking for understanding. Adaptive teaching and guided practice includes checking for understanding wherein teachers build in specific activities to assess student understanding and inform necessary next steps (Fisher & Frey, 2007; Sigler & Hierbert, 1999). Retelling, summarizing, think-pair-share, whip around, and questioning are ways to check for understanding through engaging student-centered, inquiry-based strategies (Fisher & Frey, 2007). Response cards (or white boards) where students write down their response on a card and hold it up is another way to check for understanding (Fisher & Frey, 2007). Personal response systems promote active learning and useful checks for understanding (Gray & Steer, 2012). Activities to check for understanding can be students monitoring their own learning by answering short questions, checking-off lists with short responses, clarifying questioning in oral or written form, and providing explanations to others that extend learning into peer work (Fisher & Frey, 2007).

Finley (2014) provided 53 different ways and numerous resources on alternative assessments helpful in measuring student knowledge. Finley (2014) clarified the practice of using formative assessments is superior to summative assessments in that formative assessments support student learning and growth through progress monitoring. By utilizing formative assessments, teachers become identify learning needs and adjust teaching as needed in the moment, which is also known as adaptive teaching (Finley, 2014; Hatti, 2013). Examples of formative assessment to check for understanding include alternative assessments, observation, journals, compare activities, mind maps, art projects, poetry, clickers/response systems, and checklists.

Feedback through cooperative learning. Cooperative learning can be used as a form of feedback. Peer tutoring, peer review, peer feedback, and group work are all forms of cooperative learning strategies, providing skill development in collaboration and content understanding (Marzano et al., 2001). Whether in small groups or pairs, cooperative learning works effectively and supports all students' access to curriculum despite student level (Allison & Rhem, 2007; Killen, 2007; Marzano et al., 2001).

Examples of cooperative learning strategies include think-pair-share (read and share information), jigsaws (assignments divided up and each student becomes expert to teach it to others), and give-one-get-one where after reviewing information each student writes down an idea and shares out their idea with others so at the end of the activity they have several perspectives on the same information (Marzano et al., 2001). As with any strategy teacher modeling, guided practice, peer practice, and independent practice are action learning steps (Allison & Rehm, 2007; Killen, 2007, Marzano et al., 2001).

Alternative assessment. Allison and Rehm (2007) strongly asserted assessment techniques should meet the needs of culturally diverse learners. Additionally, alternative assessments need to allow students from multilingual and multicultural classes the opportunity to demonstrate their understanding in a variety of ways (Allison & Rehm, 2007; Tileston, 2004). The variety of comprehensible assessments effectively evaluating student learning are as varied as the inputs for learning (Carrier, 2005). Many learning activities can also be considered formative assessments (Fisher & Frey, 2007). Additionally, keeping students and families informed of progress through clear communication is an effective practice for all learners and supports self-directed, proactive independent learners taking ownership and responsibility for their own lives,

which is an essential skill for middle school students (Stronge, Tucker, & Hindman, 2004).

Student voice and choice. Middle school scholars are known for their extreme volatility due their developmental stage. Keeping this in mind, middle school classroom learning environments that allow for exploration, curiosity, discovery, and experiential learning meet their developmental needs (Scott, 2013). Exploratory opportunities in service learning projects, extracurricular activities, and community involvement projects are vehicles to provide middle school students enhanced learning to support their feelings of educational achievement, develop higher levels of engagement, create positive impact on themselves and others, and strengthen personal and interpersonal development and overall well-being (NMSA, 2010). PBL, performance-based learning, multimedia presentations, electronic and paper portfolios, dioramas, and public performances are examples of activities that foster learning, promote self-directed learners, and provide students the opportunity to choose how they present information and share their voice (Cator, Schneider, & Vander Ark, 2014; Fisher & Frey, 2007).

Digital innovations surfaced in the past decade allowing for exploration, voice, and choice in myriad ways. Visual and audio media creations are possible through computer programs or online applications such as iMovie, YouTube, and Infographics, and projects can be created through gifs, memes, or posts on or student created websites (Lenz & Kingston, 2016). The possibilities are endless, allowing for deeper learning applications of content knowledge to be produced and presented (Finley, 2014).

Reflection, critique, and revision. Reflection provides openings for students to think about their learning and appropriate goals and objectives (Lenz & Kingston, 2016).

These opportunities assist students in their own learning and make them aware of their current levels of understanding and areas of needed improvement. From this understanding, students can critique their work to develop a plan for next steps to reach desired growth, set new goals, and develop a plan of action in how to achieve their goals. Goal setting supports necessary revision and empowers students to be in control of their learning with support from the teacher (Hattie, 2012). Utilizing rubrics to align content area goals helps in designing action plans and provides clear expectation in what is needed to gain a deeper level of understanding. Examples of digital innovations that support reflection and critique include digital rubrics, survey documents to guide students thinking, and blogs that offer student virtual spaces to reflect on their work (Lenz & Kingston, 2016).

Technology integrated best practices promote active participation, student interest and inquiry, and high levels of engagement where all students learn and deepen their understanding of a given concept (Cator et al., 2014). With the new age of technology, it adds another level of support to meet student needs and provides myriad opportunities to offer high levels of engagement through a variety of tools, blended learning environments, and flipped classrooms (Pearlman, 2006; Wetzel & Marshall, 2011). However, cautionary woes of losing focus, getting lost in technology, and forsaking personal relationships must not happen (Ito et al., 2008; Mishra et al., 2009).

Technology Integration Promotes Changing Teacher Role

Changing teacher role. The model of education where the teacher transmits information through lectures and textbooks is ineffective for student learning (Bellanca & Brandt, 2010; Detwiller, 2007; Saavedra & Opfer, 2012; Velez, 2012). Additionally,

the role of technology in the classroom and effective use and implementation practices by educators is crucial to how it influences student learning (Velez, 2012). Student-centered, inquiry-based PBL takes a different approach from the traditional classroom (Hirumi, 2002). Students learn how to work together in teams on an in-depth problem to answer a driving question (Pearlman, 2006). Learning activities guide student learning with differentiated scaffolds strategically incorporated into each activity. Timelines, drafts, timely feedback, benchmarks, and presentations are examples of learning activities that students participate in throughout the project. The project ends with a culminating event with an authentic audience from the community (Pearlman, 2006).

The teacher role is everchanging; however, Hattie (2012) argued teachers must consider themselves as change agents and include five major dimensions in their teaching to make a profound impact in students learning (Table 1). Hattie (2012) identified these beliefs, attitudes, and practices, and claimed these factors contributed to a teacher being classified as an excellent or expert teacher (Hattie, 2012):

Table 1

Expert Teacher Practices

Expert Teacher Practice	Explanation
1. Identify the most important ways to represent the subjects they teach	Research showed teacher subject-matter knowledge did not improve student achievement. However, expert teachers differ in how they organize and use content knowledge. They introduce new content in a way that integrates it with student prior knowledge and they adapt the lessons to student needs. They have a greater stock of strategies to help students and are better able to predict and respond when students make errors. They seek evidence of who is not making progress and problem-solve and adapt their teaching in response.
2. Create an optimal classroom climate for learning	The best climate for learning is one in which there is trust. Students often do not like to make mistakes because they fear a negative response from peers. Expert teachers create classrooms in which errors are welcome and learning is cool.
3. Monitor learning and provide feedback	Expert teachers know a typical lesson never goes as planned and are skilled at monitoring the status of student understanding. They seek and use feedback about their teaching, and regularly gather information to know who is not understanding.
4. Believe all students can reach the success criteria	Expert teachers believe intelligence is changeable rather than fixed. This means they have a high respect for their students and show a passion that all students can succeed. Although passion may be difficult to quantify, students are aware of whether their teachers exhibit this passion. In one study, students overwhelmingly stated teachers of classes with the most student achievement gains were for, teachers with the most passion (as defined by teachers who care, control, clarify, challenge, captivate, confer, and consolidate).
5. Influence a wide range of student outcomes not solely limited to test scores	Overall, expert teachers exert positive influences on student outcomes and are not confined to improving test scores. Expert teachers influence students in a wide range of ways: encouraging students to stay in school, helping to develop deep and conceptual understandings, teaching them to develop multiple learning strategies, encouraging them to take risks, helping them develop respect for selves and others, and helping develop active citizens.

Note. Source: Hattie (2012).

However, even with the use of student-centered, inquiry driven PBL and expert teacher practices, digital innovations are an ever-present resource best utilized to engage, enhance, and support 21st century skill development (James, 2009). James (2009) studied what influences the development of technology integration among middle school teachers. James (2009) highlighted the theoretical background of Albert Bandura,

stating beliefs were an important factor to self-efficacy; belief in one's capability to perform a specific task was the best predictor of motivation and behavior regarding technology integration and implementation. Nonetheless, an educator confident and capable with technology still leaves questions regarding what are the best strategies, tools, and practices for technology integration at the middle school level to support academic achievement, 21st century skill development, and student needs.

Teacher use of technology. In the research compiled by James (2009), teachers were categorized based on beliefs, motivations, and practices regarding technology; from that, five groups emerged: dynamic users, technology integrating users, knowledgeable intermittent users, limited approach users, and non-users. The teachers in the dynamic and technology integrating groups described their use of technology in rich details. The dynamic and technology integrating users overcame barriers with their environments and used technology regularly in their teaching. They believed using technology in the classroom benefited student-learning and fit well with curriculum and teaching practices. With such a belief, effective technology integration is successful for student learning (James, 2009).

Technology Integration Models and Standards of Practice

Due to the growing importance of technology embedded in society, technology literacy and application standards for both students and teachers emerged (Mayor, 2015). The National Educational Technology Standards for Students (NETS-S) and National Educational Technology Standards for Teachers (NETS-T), now known respectively as the ISTE Standards for Students (ISTE Standards•S, 2016) and ISTE Standards for Teachers (ISTE Standards•T, 2017), were designed to establish a high

level of technology proficiency. ISTE is a collaborative team committed to providing resources for professional development, knowledge generation, advocacy, and leadership for innovation to improve teaching, learning, and advancing the effective use of technology in K-12 and teacher education (Williamson & Redish, 2009). ISTE developed the standards as a systematic support for effective technology use in the classroom, and recently revised the standards (ISTE, 2016). The standards include performance indicators that define specific, measurable outcomes that evaluate teacher competency in a given area and can be used as a guide to set teacher goals (Morphew, 2012). ISTE is at the forefront of identifying the necessary skills, essential conditions, and performance indicators needed to be successful in the digital age. According to ISTE (2016), best practices for integrating technology into education focus on student learning that includes: (1) learner empowerment; (2) responsible digital citizenship; (3) knowledge construction; (4) critical thinking, problem-solving, and decision-making; (5) computational thinking;(6) creative communication; and (7) global collaboration. Standards help guide technology integration in classrooms but used alone does not make for effective technology integration (Fullan & Langworthy, 2013). In addition to standards, models of use or frameworks for technology integration are used to assess effective technology implementation in the classroom to determine academic effectiveness resulting in deeper learning. One model becoming more known is Technology Pedagogy Content Knowledge (TPACK).

Technological pedagogical content knowledge (TPACK). Just looking at standards can minimize the technology and its use to a linear path when learning and technology is a complex, multifaceted process (Mishra & Koehler, 2008). The TPACK

framework presents an innovative way of thinking about preparing and supporting teachers to use technology and package content aligned with the ISTE-T performance standards (ISTE, 2017). TPACK encompasses the understanding that arises from multiple interactions with content, pedagogical, and technological knowledge (Figure 2).

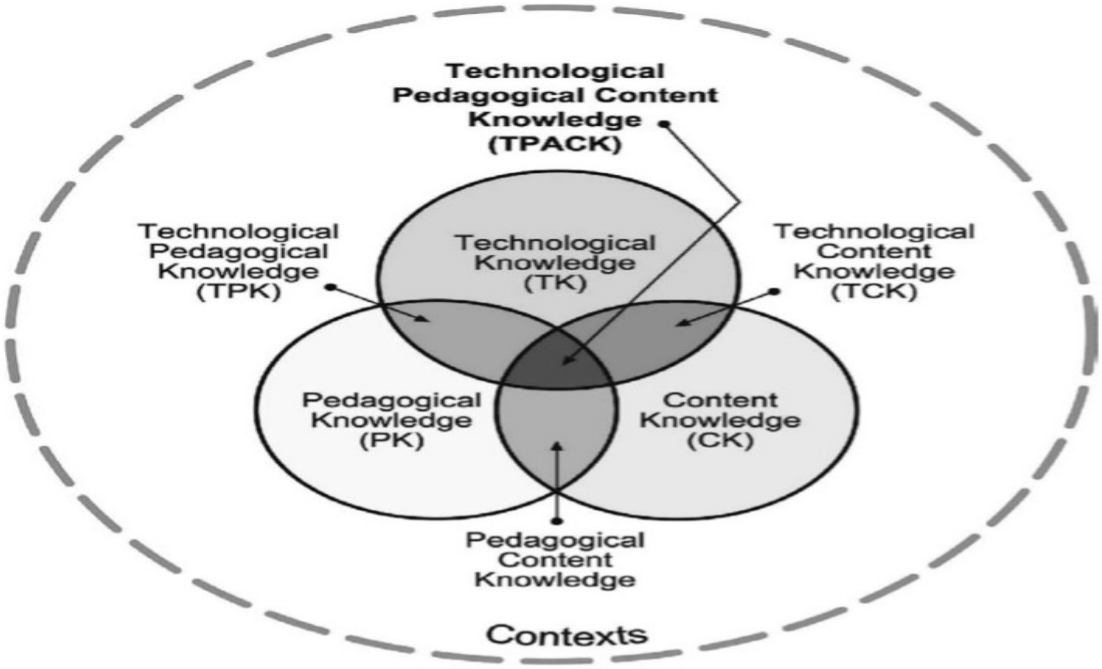


Figure 2. TPACK framework interweaving technology, content, and pedagogy. Adapted from Koehler and Mishra (2009).

Mishra and Koehler (2008) created a conceptual tool to assist teachers in planning lessons that integrate technology. The framework requires equal attention to technology, pedagogy, and content in designing curriculum (Mishra & Koehler, 2008). Additionally, the TPACK framework is increasingly becoming a useful tool for researching technology integration in education (Mishra et al., 2009; Wetzel & Marshall, 2011). Scholars debated that knowledge about technology cannot be isolated from its

context or use and one of the requirements of good teaching is understanding how technology relates to pedagogy and content (Mishra et al., 2009).

The "T" in TPACK refers to knowledge about basic technologies such as textbooks and whiteboards, as well as advanced technologies such as the Internet, digital devices, and web applications (Koehler & Mishra, 2009). Additional understanding of digital technologies, operating systems, and computer hardware and software provide teachers a broad knowledge to apply them productively and recognize how technology can help or obstruct accomplishing a given learning objective. The "CK" in TPACK refers to content knowledge (CK), which is the subject matter knowledge to be learned by students. CK consists of knowing the subject taught, including basic facts, central ideas, concepts, theories, and how to connect those through specific curriculum. The "PK" of TPACK denotes pedagogical knowledge (PK). PK refers to understanding about the processes of learning and how it serves to meet educational purposes, goals, and objectives for learning. This generalized knowledge embodies all concerns of student learning, classroom management, curriculum development, implementation of learning objectives, strategies, and techniques to support learning and assessing student understanding (Koehler & Mishra, 2009).

An example of TPACK was provided by Wetzel and Marshall (2012). They analyzed a sixth-grade teacher to look for interplay between components of the framework. The researchers observed and interviewed the teacher and discovered results that helped illuminate the framework to a real-life scenario. Pedagogical knowledge was clearly addressed through learning objectives the teacher listed on the whiteboard and clarified with each lesson. The content and pedagogical knowledge

interplay was the teacher's use of the writing process to guide student understanding of the Renaissance. Three language arts activities (writing a poem, summarizing articles, and a writers' workshop) were used as learning activities to address content objectives in language arts and the Renaissances. Peer edits, review and feedback, group work, teacher modeling, discussing the processes of the learning activities provided additional evidence of the interplay of content and pedagogical knowledge. Additionally, the pedagogy process used by the teacher was PBL supported by a learning environment that was student-centered and inquiry driven (Wetzel & Marshall, 2012).

Technological knowledge was provided through computer applications and effective classroom management (Wetzel & Marshall, 2012). Students were encouraged to teach each other the computer applications and were considered the experts in the room to support each other as new technologies were introduced. Classroom expectations and procedures were evident as the students entered the room; they had laptops on their desks, looked at the board for an assignment, and knew to close their laptops upon direction. The interweaving of pedagogy, content, and technology were evidenced through the learning activities and culminating project presentations (Wetzel & Marshall, 2012).

In addition to the ISTE standards and TPACK, another framework to support technology integration is the Substitution Augmentation Modification Redefinition model (SAMR; Juliani, Corrente, & Dell'Acqua, 2011). SAMR is designed to help educators infuse technology into teaching and learning (Juliani et al., 2011). The model supports and facilitates teachers to intentionally design, strategically develop, and creatively infuse digital learning experiences in effective ways (Richardt, Church, &

Morrison, 2011). The teacher goal is to construct a SAMR ladder and identify where learning activities align. This structure provides adjustment of task to support deeper learning environments with cognitively complex tasks developing critical thinking skills in purposeful, engaging activities (Puentedura, 2014; Schrock, 2013).

Puentedura (2012) developed the SAMR model in the late 1980s to assist with address what types of technology are best for optimal student learning. The name was based on student results; for example, the "S" stands for substitution, wherein technology substitutes an earlier form of technology. An example of substitution is a word processer used in the place of a typewriter. The level of use is the substitution level, wherein student performance is similar regardless of technology used (Puentedura, 2012).

The next level in the SAMR model is augmentation. Augmentation is substitution with enhancements (Puentedura, 2012). Using the word processer example, adding spell check or cut/paste are forms of augmentation. Usefulness of the technology tool are important, however minimally change student performance. Modification is the next level in the SAMR model, where the task is significantly redesigned by the introduction of an innovative technology. Using the word processing example, the document is now becoming a multimedia form of communication when applying blogs, email, websites, or social software, allowing other applications of learning through group analysis, peer feedback, editing, and revising, all resulting in enhanced student performance and deeper learning. Deeper learning in cognitively complex tasks is the result of what Puentedura (2012) called the redefinition level in the SAMR model. The word processing document becomes a thinking document empowering student learning

to dive deeper and grow as they express knowledge through multiple outlets. The SAMR model provides curriculum development a filter to align technology integration and use to question and anticipate what level of student learning would result with the introduction of a specific technology (Puentedura, 2012).

The Levels of Teaching Innovation (LoTi) framework conceptualized by Dr. Chris Moersch (1995) was designed as a research tool to assess authentic classroom technology use. However, over many iterations, the original framework evolved to provide a conceptual model to measure classroom teacher implementation and effectiveness of digital innovations to provide deeper learning. The LoTi framework, has seven implementation levels, each designed to analyze whether the curriculum is teacher-centered or student-centered. The goal is to support instructional shifts while employing technology to accelerate learning. The developmental implementation levels range from zero (nonuse level) to level 6 (refinements level). As a teacher progresses from one level to the next, it supports a series of transformations from teacher-centered to learner-centered. Moersch (1995) suggested LOTI balanced instruction, assessment, and technology resources to help students develop 21st century skills.

The ISTE standards, TPACK model, SAMR model, and LoTi framework provide foundational understandings; some of the models starting to emerge over the last decade support instructional shifts in technology integrated classrooms, resulting in deeper learning. These models provide a common language to the ever-evolving, rapidly paced educational environments integrating technology (Juliani et al., 2011). Using a common language and learning from each other can guide continued development in this ever-changing world of education wherein the use of models is

multipurpose and help support effective application of technology across various academic disciplines (NETS-T, 2002).

Technology integration is sometimes hard to describe and is used as a broad umbrella term with a large variance of meanings and ways to look at technology integration (Edutopia, 2007; Fullan & Langworthy, 2013). Hertz (2011) described *seamless* technology integration in which, "Students employ technology daily in the classroom using a variety of tools to complete assignments and create projects that show a deep understanding of content" (p. 2). Hertz (2011) defined levels of technology integration (Table 2), contending this was a starting point to understand the levels of technology integration in classrooms.

Table 2

Technology Integration Levels

Level of Technology Integration	Descriptors of Level
Sparse	Technology is rarely used or available. Students rarely use technology to complete assignments or projects.
Basic	Technology is used or available occasionally, often in a lab rather than the classroom. Students are comfortable with one or two tools and sometimes use these tools to create projects that show understanding of content.
Comfortable	Technology is used in the classroom on a regular basis. Students are comfortable with a variety of tools and often use these tools to create projects that show understanding of content.
Seamless	Students employ technology daily in the classroom using a variety of tools to complete assignments and create projects that show a deep understanding of content.

Note. Taken from Hertz (2011, p. 2).

Technology Integration Best Practices in in Middle School

Systems of education are trying to meet increasing demands by reconfiguring schools where learning can happen in different ways than ever before (Heick, 2014). With this demand, understanding and integrating effective use of technology to support high-quality learning is essential.

As of 2009, Pew Research Center's Internet & American Life Project discovered that 93% of American teens aged 12-17 went online (Lenhart et al., 2010). Engagement in learning is essential for knowledge acquisition and understanding (Casey et al., 2000; Cennamo et al., 2014; Magana & Marzano, 2015). This lends to the logic of why using technology integration applications such as social media, web application, and resources from the Internet engage student learning supports connections to student lives resulting in deeper learning, retention, and application of knowledge (Harris et al., 2009; Lenhart et al., 2010).

The degree to which technology is beneficial depends heavily on the effectiveness of is use and application in the classroom (Harris et al., 2009). Technology integration best practices identified in the beginning of this chapter work well with middle school students. The next few sections address in more detail specific areas of technology application effective with middle school classes when integrated with the best practices.

Effective Use of Computer and/or Web-Based Applications

Effective use of computer and/or web-based applications in conjunction with best practices and effective pedagogical methods can provide optimal technology infused learning opportunities (Fullan & Langworthy, 2013; McDowell, 2017). An

example of this is the use of social media in the classroom. Social media in the learning environment when used effectively can allow for an authentic audiences and resources for students to connect with while solving real-world problems (Anderson, 2012; Baker, 2014). Examples include students connecting via the Internet/ with artists, architects, engineers, writers, farmers, cooks, scientists, animators, social scientists, community leaders, business owners, and other experts in the field. Experts can provide mentoring, information, and research (Bergmann & Sams, 2012; Heick, 2014). The possibilities are abundant for using social media and provide middle school student the cooperative social environment in which they thrive (Baker, 2014; Heick, 2014; Holland, 2014).

Another example of a social media application that can be used schoolwide is Twitter chats (Baker, 2014). Twitter chats allow students to connect, collaborate, share, and learn. One Twitter chat known for middle school use is Kidsdchatnz. In Kidsdchatnz students from New Zealand are provided a chat topic, teachers flip the classroom by providing the materials students are to read or research about before responding to the chat, and a weeklong session on the topic ensues. Weekly chat topics are provided throughout the year and student expectations are clearly defined resulting in high-quality, meaningful tweets (Baker, 2014).

Another form of online discussion using technology with collaborative discourse is webinars. Webinars are defined as computer-mediated communication (CMC) systems use to support online learning (Wang & Hsu, 2008). Wang and Hsu (2008) described two forms of CMC: synchronous (real-time) or asynchronous (delayed-time). Synchronous webinars include voice-over technologies, instant messaging, and video conferencing. Asynchronous technologies include emails, bulletin boards, recordings,

and blogs. Middle school students use email, instant messaging, video conferencing, blogs, and videos. An example of a webinar for middle school students is Backchannel (Holland, 2014). Backchannel is a digital conversation simultaneously happening during a face-to-face activity, which provides students the opportunity to participate in an ongoing conversation (Holland, 2014). These types of applications continue to support effective technology integration and are helpful in providing inquiry-based, social interactions throughout the school day, establishing learning objectives, and maintaining high learning expectations (Magana & Marzano, 2015).

Blogging is an application that can be used for feedback, reflection, critique, and digital storytelling. Blogging offers an engaging, relevant, and rigorous environment with a real-world application and authentic audience (Fryer, 2009; Lopez, 2010). Middle school students enjoy learning about themselves, telling others about themselves, and learning about others in their school (Lopez, 2010). Blogging provides an avenue for them to share what they know on a given topic guided by exemplary digital citizenship expectations. Blogging teaches students how to write responsibly, receive and give helpful peer feedback, and learn from one another (Fryer, 2009). Students can learn how words affect others, how to share ideas respectfully, and the importance of their ideas and recognition of their digital footprint (Fryer, 2009). Blogging can include audio representations of information or student creations, also known as podcasts.

Podcasts are known as the auditory processing learners dream application (Gloer, 2007). Auditory learners benefit from this technology tool, and student learning is enhanced when they can learn by listening and creating their own podcasts. The technical definition of a podcast is a digital audio file of spoken/verbal information

made available on the Internet for downloading to a computer or portable media player that can be distributed and listened to at the listener's convenience (Van Orden, 2014). Podcasting offers a variety of content for listeners to consume how they want, when they want, and where they want (Van Orden, 2014). This is one of the many examples of how to use technology in comprehensive forms to promote student-centered inquiry matched with high levels of engagement to meet expectations.

Digital applications described above are useful in engaging middle school students combined with effective teaching practices. Darrow (2012) defined blended learning from a teacher perspective as a pedagogical approach facilitated by a teacher where students had some control over their learning and the teacher seamlessly incorporated the use of online learning tools (e.g., discussion boards, online collaboration, blogs). Technology tools and face-to-face instruction were blended to deliver instruction so learning could be accessed at any time.

Petty (2012) purported technology as a successful avenue to meet middle school needs and help them be more engaged in school when used effectively. A study asked 4,000 middle school students what they needed to be engaged and successful academically in school (Spires et al., 2008). The students reported using computers more in school and home, and developing high levels of computer skills could help. The study supported middle school student interest but did not detail what effective practice would look like in the middle school classroom (Spires et al., 2008).

Petty (2012) stated technology integration can be categorized into three main strands: interactive, learning experiences and assessment, and research and problem-solving. Petty (2012) found interactive applications provide learning activities that

accommodate middle school needs, providing physical activity, creative expression, positive social interactions with adults and peers, frequent transitions, and social activities in a media-rich environment. Providing a digital learning environment and encouraging active participation where students set, monitor, and manage their learning to meet their goals empowers adolescents to take ownership of their learning and progress (Petty, 2012). Educators today have the power to change the world in the way they respond, implement, and integrate emerging technology. However, with the use of technology comes the resistance of change. Additionally, development of best practices is still being defined and although there are many resources, how to best utilize these resources for effective technology integration in middle school still goes unanswered (Godfrey, 2013; Petty, 2012).

Barriers to Technology Integration

Over the past decade, with the massive penetration of technology into educational organizations, research findings are disappointing as to the progress of supporting academic achievement (Avidov-Ungar & Eshet-Alkalai, 2014). Research suggested effectiveness of innovative technology integration into educational organizations is lacking due to key factors regarding cognitive, organizational, and affective challenges that require definitive changes in an organization's culture (Avidov-Ungar & Eshet-Alkalai, 2014). Many factors contribute to a lack of successful technology integration, which range from attitudes, beliefs, and institutional structures to limited resources, funding, skills, time, technical support, and knowledge (Boss, 2008; Ertmer, 1999; Hew & Brush, 2007). According to Kopcha (2012), barriers to

integrating technology fall into five areas: (a) access, (b) vision, (c) beliefs, (d) time, and (e) professional development.

Access

Given the mandate that students need to be better prepared for the 21st century, policies and funding to support change are essential. To successfully implement technology at a school site and in the classroom, teachers need to feel capable and have the resources to create and sustain effective learning environments where students are engaged and learning at deeper levels (Adedokum, 2016). One specific area of support needed in addition to funding for infrastructure is well-structured leadership (Machado & Chung, 2015). Successful technology integration requires the full support from school principals and district administrators (SETDA, 2015). SETDA and ISTE both agreed leadership was an essential condition to effective technology implementation (ISTE, 2016; SETDA, 2015). Leadership needs a clear vision and transparent mandates that all teachers will use technology (Adedokum, 2016; ISTE, 2016, SETDA, 2015).

Professionals across the education and technology arenas worked in response to the growing digital divide and developed the Leading Education by Advancing Digital Commission (LEAD, 2012). LEAD (2012) created a five-point blueprint for technology integration. The first goal is to solve the infrastructure challenge by upgrading school wiring. LEAD Commission is working with broadband connectivity companies to provide reduced rates and powerful connectivity to enable schools and students to have working WiFi. Second, LEAD is working on building a national effort to deploy devices into the hands of all students by 2020. The hope is to make devices affordable through aggressive programming with manufacturers and school districts. The third

goal is to accelerate the adoption of the digital classroom. However, despite this effort, unavailability of required resources continues to create barriers to use and integration despite the legislature addressing the need to support digital classrooms. Work is still needed in the following areas: working with state and district purchasing for more timely procurement processes, creating independent certification programs to support high-quality curriculum, and targeting entrepreneurs, businesses, and researchers to bring in new effective products. LEAD Commission's fourth goal is to embrace and encourage model schools. LEAD is still working to identify exemplary examples of digital learning implementations and to help others learn from and finds ways to support model schools continued growth. The fifth goal is to invest in human capital. LEAD is looking for ways to help build teacher capacity and professional development through the creation of master teachers who can help train other teachers in best practices (LEAD, 2012).

In addition, LEAD (2012) set forth to address and reverse the growing inequities regarding digital learning access between high- and low-income students and school districts. Many digital tools are widely used in the classroom, but teachers worry about digital divides when it comes to student access to technology between high- and low-income students (Purcell et al., 2013). Teachers are concerned and face many obstacles when teaching low-income students when they bring technology into the classroom to because of a gap regarding who has access and who does not. More needs to be done to reverse the achievement gap and provide access to students so they can succeed in today's technological environment (Purcell et al., 2013).

Vision

Research shows an apparent gap in the use of technology for instructional purposes (Kopcha, 2012). Teachers face many barriers with technology integration in their classrooms (Ertmer, 1999). One area that creates a barrier for effective technology integration is lack of vision for technology and its use (D. Hayes, 2007). D. Hayes (2007) discovered when teachers were asked whether technology had an impact on classroom practices, many had difficulty identifying any impact (D. Hayes, 2007). D. Hayes (2007) found these teachers were only substituting existing practices with new technologies and not redefining its use for deeper learning because of the teachers lack of changing their view about technology use. Once teachers changed their views about technology through the support of a mentor or colleagues while building their capacity, technology began to open new opportunities resulting in changing instructional practices that were more child-centered, engaging, and provide deeper learning environments for students (D. Hayes, 2007; Park & Ertmer, 2008).

Beliefs

In the research compiled by James (2009), teachers were categorized based on their beliefs, motivations, and practices. Dynamic and technology integrating users overcame barriers and used technology in their teaching regularly. They believed using technology benefited student learning (James, 2009). However, teachers with a limited approach created a barrier in their own use based on their perceptions (Kim, Kim, Lee, Spector, & DeMeester, 2013). Time and training are needed to support continued development and change the beliefs of teachers (James, 2009).

Time

Research found teachers with strong vision, capable, well-educated, and skilled with technology still did not integrate technology effectively as a learning tool due to limited time on task and planning (Bauer & Kenton, 2005). Students with insufficient time to work on computers became a repeated pattern when asked why computers were not used regularly in the classroom. Additionally, time to plan became another barrier for why teachers did not become effective integrators of technology (Bauer & Kenton, 2005). Lastly, when teachers were not effective with technology integration, they found student misbehavior rose and time on task was not the focus of teacher attention, but rather dealing with inappropriate behavior (Wachira & Keengwe, 2010).

Professional Development

Research showed a vast array of barriers impacting technology integration; however, despite the barriers, common themes were evident throughout education (Godfrey, 2013). One theme as a barrier to successful, sustainable, effective technology integration was available professional learning (Lawless & Pellegrino, 2007). Research found technology hardware and tools were made available to teachers and classrooms at an abundant rate, but effective training to support its use could not keep up with the demand (Lawless & Pellegrino, 2007).

Cuban (1993), an expert on educational history, asserted that education incorporated one fad or another only to be replaced by something new, and technology integration was one more example of this trend. Cuban et al. (2001) defined technology as anything a teacher uses to help instruct students. Despite a clear definition of technology integration, consistent use of computing devices for instruction lacked

ongoing professional development (Edutopia, 2007; Hew & Brush, 2007). Early research of effectiveness of educational technology wherein computer assisted instruction was used to support drill and practice activities was inconsistent in supporting academic achievement (Godfrey, 2013; Wenglinsky, 2005). Additionally, Apple Computers of Tomorrow used technology to build higher-order thinking skills resulting in a change of teaching practice, but the impact on student achievement was mixed (Figg & Jaipal, 2012; Wenglinsky, 2005). Incorporating frameworks and standards of practice is helping educators become effective with technology integration to develop best practices for successful and engaging learning environments (Edutopia, 2007; Mishra et al., 2009).

Summary

Middle school students are developmentally unique, needing specific learning environments to meet their needs (AMLE, 2010). Participatory and engaging learning environments support deeper learning while developing 21st century skills (P21, 2008). Positive benefits of technology integration include students completing greater amounts of work, being more focused and on-task, achieving higher grade averages in reading and writing, and accessing curriculum to help their understanding (Godfrey, 2013). From the research, it was evident many resources exist for technology use, yet further research is needed to define best practices for effective technology integration in middle school (D. Hayes, 2007; Glick, 2014; Kopcha, 2012). Technology used appropriately and effectively can meet the needs of middle school students (Boss, 2011).

This chapter presented a review of the literature. The next chapter outlines the methodology used for this study, including data collection and analysis procedures.

CHAPTER III: METHODOLOGY

This chapter discusses the methodology used to conduct this study, which examines best practices utilized by expert middle school teachers. The chapter begins with a review of the purpose statement, research questions, and research design. The chapter then provides an extensive overview of the justification for the research design, population, sample, research instruments, methods of data collections, and methods of data analysis. The final section covers methodological assumptions, limitations of the study, and the ethical procedures engaged to safeguard the protection of human subjects. The chapter concludes with a summary of the overall methodology of this study.

Purpose Statement

The purpose of this mixed methods sequential explanatory study was to identify and describe best practices in technology integration in middle school classrooms as perceived by expert middle school teachers. Additionally, it was the purpose of the study to determine the most important best practices and perceived barriers to successful technology integration as perceived by expert middle school teachers.

Research Questions

1. What are the best practices in technology integration in middle school classrooms as perceived by expert middle school teachers?
2. What are the most important best practices in technology integration in middle school classrooms as identified by expert middle school teachers?
3. What are barriers to successful technology integration in middle school classrooms as perceived by expert middle school teachers?

Research Design

A mixed method sequential explanatory research design was used to identify and describe best practices utilized in technology integration in middle school. Mixed method sequential explanatory research designs use a two-step design whereby the data for the quantitative component is collected followed by gathering qualitative data to further explain, elaborate, or clarify the quantitative results (Creswell, 2014). This QUAN-qual design first collects quantitative data to provide initial information to explain the phenomena being studied, then uses the qualitative data to refine and explain wherein both forms of data are integrated in the design through merging, connecting, or embedding the data to fully explain the phenomenon (Creswell, 2014; McMillan & Schumacher, 2010). This design "captures the best of both quantitative and qualitative data- to obtain quantitative results from a population in the first phase, and then refine or elaborate these findings through an in-depth qualitative exploration in the second phase" (Creswell, 2002, p. 567). This design was selected because it was the most appropriate approach for addressing the purpose of the study and answering the research questions. This mixed methods sequential explanatory research design combines the quantitative component that explains the *what* with the qualitative component explaining in further detail the *why* (Creswell, 2014; McMillan & Schumacher, 2010). Figure 3 depicts a graphic representation of the sequential explanatory mixed methods design.

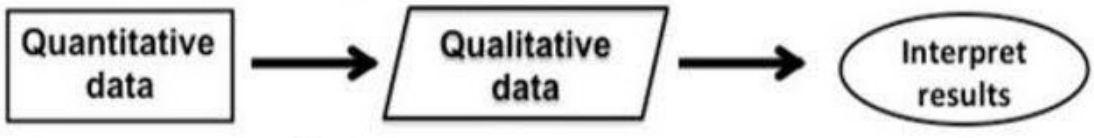


Figure 3. Sequential explanatory mixed methods research design.

Quantitative Research

Gay, Mills, and Airasian (2009) defined quantitative research as the type of educational research that involves the collection and analysis of numerical data to describe, explain, or predict phenomena. Techniques used in quantitative research include survey research, correlational studies, experimental or causal comparative designs, and database analysis (Gay et al., 2009; McMillan & Schumacher, 2010; Patten, 2012). The numerical data are statistically analyzed, providing sufficient information to address the research questions. The focus of the data analysis was to identify best practices used by expert middle school teachers effective in integrating technology in their classrooms. McMillan and Schumacher (2010) stated, "Surveys are used to determine people's attitudes, beliefs, values, demographics, behavior, opinions, habits, desires, ideas and other types of information" (p. 235). Descriptive research is obtained by acquiring information pertaining to an existing phenomenon, program, case, or situation and is a part of quantitative study (McMillan & Schumacher, 2010; Patton, 2002). This descriptive research used subject and survey questionnaires to describe best practices of technology integration in middle schools. Descriptive research was elected for the study because the goal was to describe, explain, and identify the practices of expert middle school teachers integrating technology in their classrooms.

Qualitative Research

Qualitative research methods comprise the collection, analysis, and interpretation of narrative and visual data such as case study research, in-depth interviews, or focus groups (Gay et al., 2009; McMillan & Schumacher, 2010; Patten, 2012). Creswell (2014) described qualitative research as, "Research in which the researcher relies on the

views of participants; describes and analyzes these words for themes; and conducts the inquiry in a subjective, biased manner" (p. 46). In qualitative research, the information obtained is more general in nature. Respondents are asked open-ended questions for the researcher to gather words, phrases, stories, and descriptions based in a natural setting (Creswell, 2014; Gay et al., 2009; McMillan & Schumacher, 2010; Patten, 2012). Krathwohl (2009) posited qualitative findings provided the human side of research, attaching emotions and feelings to phenomena to empower understanding by the reader.

Population

A population is a group that embodies the characteristics of a distinct grouping of individuals, articles, artifacts, or activities that conform to conditions that researchers want to understand pertinent to the research questions (McMillan & Schumacher, 2010; Patten, 2012). Creswell (2014) described a target population as a group of individuals with the same characteristics. Additionally, target populations were recognized as a group of individuals where the findings of the research could be generalized (Gay et al., 2009). The population utilized for this study was California middle school teachers and the target population was middle school teachers considered experts at technology integration in the middle school classroom. Table 3 shows the student enrollment and number of schools by type in California.

Table 3

Enrollment and Number of Public Schools by Type: 2014-15

School Type	Enrollment	Number of Schools
Elementary	3,112,698	5,825
K-12	138,724	242
Middle/Junior High	1,022,402	1,347
High	1,776,132	1,337
Continuation	60,027	460
Alternative	63,331	259
Community day	4,225	204
Special education	21,507	133
Other	36,474	586
Total	6,235,520	10,458

Note. Total enrollment count includes students enrolled in charter schools. Adapted from California Department of Education (2016).

According to the National Center for Education Statistics (2016), there are 10,458 public schools in California. Of those, 1,347 are middle schools. California's large population of middle schools and geography with lengthy distance across the state contributed to why the researcher used convenience sampling. Convenience sampling is a method that relies on data collection from population members conveniently available to the researcher (Patten, 2012). The accessible population for the focus of this study was middle schools in the counties of Contra Costa, Marin, Napa, Sacramento, and Solano. Contra Costa has six middle schools, Marin County has six middle schools, Napa has six middle schools, Sacramento has 13 schools and Solano County has 12 middle schools for a total of 43 middle schools in these counties (Table 4).

Table 4

County and Number of Middle Schools

County	Number of Middle Schools
Contra Costa County	6 middle schools
Sacramento County	13 middle schools
Marin County	6 middle schools
Solano County	12 middle schools
Napa County	6 middle schools
Total	43 middle schools

Note. Adapted from California Department of Education.

These 43 middle schools were the prospective target population the researcher wished to generalize the data collection. In this study, the researcher sought to identify and describe the practices of middle school teachers effective at integrating technology.

Sample

Krathwohl (2009) defined a study sample as a subset of a larger group representing the whole. The study sample referred to the subgroup of the target population from whom the researcher planned to collect data, also known as participants (Krathwohl, 2009; McMillan & Schumacher, 2010). Creswell (2014) stated "The target population or 'sampling frame' is the actual list of sampling units from which the sample is selected" (p. 393).

The researcher used purposive criterion sampling for this study. "Purposive sampling involves the selection of a small number of cases from a larger population" (McMillan & Schumacher, 2010, p. 399). The sample for this study was expert middle school teachers who met the following criteria:

- Taught sixth, seventh, or eighth grade in a public school located in California within the specified counties (Contra Costa, Marin, Napa, Sacramento, and Solano)
- Spent at least three years in middle school teaching with technology
- Received specific training or certifications in technology
- Held a leadership role in integrating technology
- Authored papers or presented at workshops/conferences re: technology
- Confirmed as an expert middle school technology teacher by the principal or superintendent

Convenience sampling is a non-probability type of sampling that relies on data collection of participants conveniently available to participate in the research (Patten, 2012). As the study focused on best practices of expert middle school teachers, it was necessary to narrow the sample to specific middle school teachers currently integrating technology in their classroom and located geographically near the researcher. Figure 4 shows the narrowing from the population to the sample. The researcher contacted the superintendents of the school districts listed on the California Department of Education website as residing within the specified counties. The superintendent was contacted for permission to conduct the study and for names of teachers who met the study criteria. The superintendent either contacted the teachers themselves or allowed the researcher to contact the site principal to recruit teachers to participate in the study. Once teachers confirmed their willingness to participate, a link to the electronic survey was sent to them, which resulted in 34 participants.

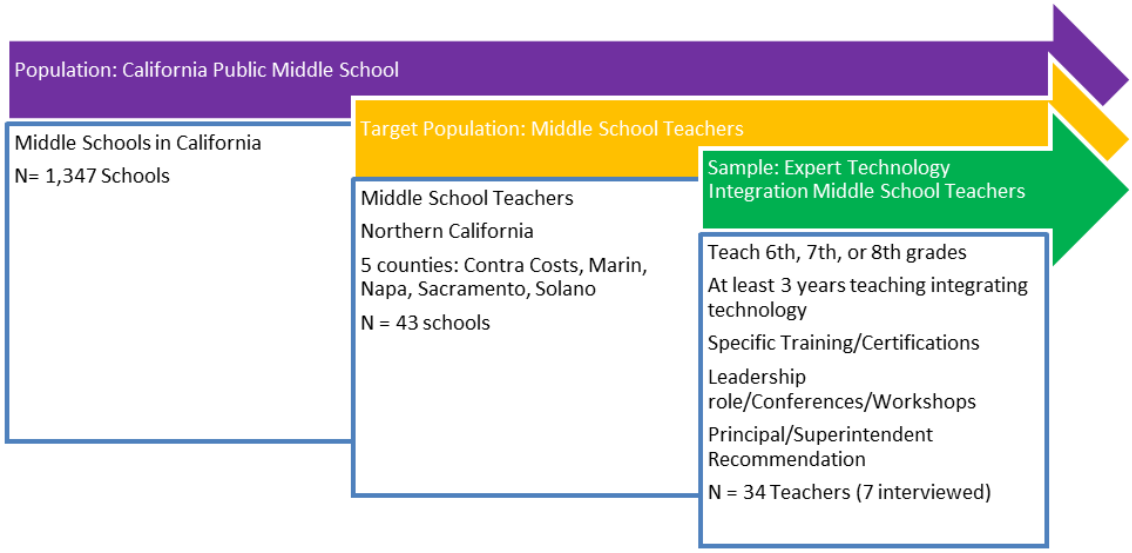


Figure 4. Graphic representation of narrowing from population to sample.

Instrumentation

Instrumentation was defined as tools for measuring, observing, or documenting quantitative data (Creswell, 2014). For this study, both quantitative and qualitative instruments were used to collect data. When combined, the strengths of both methods "provides for a more comprehensive picture of what is being studied" (McMillan & Schumacher, 2010, p. 396). Quantitative data were gathered by an online survey and qualitative data were collected through semi-structured interviews.

Quantitative Instrumentation

As explained by McMillan and Schumacher, (2010) descriptive explanatory data are used to, "describe and explain the patterns related to the phenomena…to examine new or little-understood phenomena" (p. 324). One tool to obtain descriptive data for research is online surveys, also known as electronic questionnaires (Krathwohl, 2009). The researcher used surveys acquired from published dissertations to gather quantitative data. Using existing instruments built off the established validity of scores obtained

from past use of the instrument (Creswell, 2014). Creswell (2012) supported the collection of data in quantitative research by using the most current version of an instrument available, noting preestablished instruments used extensively in other studies provided validity of information. For this reason, the *Best Practice Implementation of Middle School Technology* survey (Appendix B) was created using ideas from published surveys. Because no one survey was sufficient to collect the needed data to answer the research questions, it was necessary to use ideas from multiple sources wherein the researcher created an original survey to meet the needs of this study. The three resources of published information were the International Society for Technology in Education Student Standards (ISTE, 2016), the Survey of Middle School Teachers at Research Site (Petty, 2012), and questions in relation to barriers of technology education excerpted from the *Teachers Integration Survey* (Adedokum, 2016). Permission to use ideas from these instruments was secured prior to using them for data collection (Appendix E).

Qualitative Instrumentation

Qualitative interviewing begins with the assumption the perspective of others is meaningful, knowable, and able to be made explicit (Patton, 2002). The purpose of this study was to gather data from various individuals regarding their best practices that support successful technology integration in middle school classes. In alignment with this purpose, interviews were used as the supplementary method of data collection. Interviews followed the online survey, allowing the researcher to gain a deeper understanding.

The purpose of the interviews was to obtain information on current practices and strategies used in technology integrated classrooms. Meeting face-to-face was the first option requested, but when that was not feasible interviews were conducted through web-conferencing or telephone. Participants did not have to answer any questions they do not wish to answer. The researcher was as unobtrusive as possible taking notes on a laptop or writing in a research journal. Participants were contacted within a few weeks of the interview if any clarification was needed regarding the information gathered.

Validity

In research, validity determines the degree of truthfulness in which the results represent the actual phenomenon (McMillan & Schumacher, 2010; Patten, 2012). Expert panels are often used when specialized input and opinion is required to assess the validity of an instrument or study (McMillan & Schumacher, 2010; Patten, 2012). In this study, an expert panel was utilized to support the validity of the data collection instruments, as well as ascertain the usefulness and meaning of data collected. This expert panel consisted of leaders in the field of educational technology known for their expertise in technology integration.

The researcher developed the survey instrument (Appendix B) to align with the stated purpose and research questions. A large portion of the survey was generated with permission from Dr. Donna Petty using the survey from her 2012 dissertation, which also explored best practices in technology integration. For purposes of integrity and validity, each survey item was cross referenced to the applicable ISTE standard and represented in the literature. A panel of experts was utilized to review and confirm the instruments' content validity. The expert panel consisted of three individuals who each

(a) had experience as district superintendents; (b) provided technology expertise as conference presenters, bloggers, or content providers; (c) had years of membership and/or leadership in ACSA Technology Leadership Committee; and (d) were recognized for their technology leadership. The panel of experts was given the link to the survey to review and validate the content and provide feedback. Each expert provided meaningful feedback which the researcher utilized to revise the survey instrument prior to administration.

Quantitative research content and construct validity. Validity in quantitative research is to establish whether one can draw meaningful and useful inferences from scores on the instrument used. Creswell (2014) explained three traditional forms of validity in quantitative research: (a) content validity (do the items measure the content they intended to measure); (b) predictive or concurrent validity (do scores predict a criterion measure, do results correlate with other results); and (c) construct validity (do items measure hypothetical constructs or concepts). Due to this research utilizing excerpts from instruments used in published dissertations, content and construct validity were already established.

Qualitative research content and construct validity. In qualitative research, validity "refers to the degree of congruence between the explanations of the phenomena and the realities of the world" (McMillan & Schumacher, 2010, p. 330). Validity requires the researcher and participants to establish a common understanding of the concepts and phenomena under study (McMillan & Schumacher, 2010; Patton, 2002). To provide for content validity, the interview questions were developed based on an

extensive review of literature and with assistance from an expert panel; additionally, ideas from existing survey questions and published dissertations guided development.

McMillan and Schumacher (2010) explained, "Good qualitative questions include interview script critiques by experienced interviewers, interview guide field testing, and revision of initial questions of final phraseology" (p. 357). These techniques also establish the reliability of qualitative data. To enhance validity and reliability, the following strategies were employed: (1) interview protocol and script were developed based on best practices and aligned to ISTE Standards, (2) the protocol was reviewed by an expert panel, (3) the instrument was field tested to ensure a common understanding and clarify participant language, (4) responses were digitally recorded and transcribed, and (5) participants reviewed transcripts for accuracy. The participant language was used to design clear and concrete interview questions in familiar language to the interviewees. In addition, the researcher provided participants with working definitions of terms used in the questions. An established common understanding of these terms helped ensure comprehension of interview questions. Moreover, a recording device was used during participant interviews to ensure a verbatim collection of their words rather than relying on the researcher's written account and memory. Finally, participants were provided the opportunity to review the transcription of their interview to verify their experiences were accurately captured.

Reliability

In addition to validity, the reliability of the survey questions was sought. Reliability refers to the ability of the instrument tool to produce consistent outcomes (Patten, 2012). The reliability for this study was determined through an instrument field

test. McMillan and Schumacher (2010) stated test-retest reliability could be achieved by administering the test to the same individuals twice over a period of time. Participants from a pre-identified site not participating in the study were asked to take the survey and participate in the interview process to determine if the results were effective. These selected educators were asked to field-test the survey and interview questions. A field test increases reliability in this study by safeguarding the neutrality of the researcher and ensuring questions accurately align to the research questions and provide an opportunity for revisions to the survey questions and interview process prior to actual data collection (Creswell, 2014; McMillan & Schumacher, 2010). Field test participants were asked to review the survey questions (Appendix B), interview protocol (Appendix D), and the interview questions (Appendix D), and provided feedback on the following areas: structure, sequence, and reliability of interview questions; clarity of interview questions; length of questions and interview; and the recording process. Revisions were made based on feedback from the field test participants and dissertation chair.

Data Collection

Quantitative Data Collection

For quantitative data collection, an online survey was developed with excerpts from an existing dissertation on technology integration best practices. Data were collected via survey. Teacher names and contact information were compiled and a request to participate in the study was sent via email. Letters and contact information of middle school experts of technology integration were requested through specified organizations. A list of potential participants was compiled. Letters to districts requesting participation were emailed and followed-up for confirmation of participation.

Upon district approval, a letter was sent to the principal or site administrator requesting participation in the research. Once approved, emails and letter inviting selected teachers considered experts in technology integration were invited to complete the survey. Each respondent to the electronic survey (Appendix B) first received a landing page with information regarding informed consent (Appendix C). To proceed to the survey, participants needed check a box indicating they read the informed consent form and understood their participation was voluntary. Teacher participants were assured all information was confidential and no identifying data were shared in any way. After signing the informed consent form, a link to the online survey was delivered to participants.

Qualitative Data Collection

On the survey, teachers were given the opportunity to volunteer to participate in a follow-up interview. Those who volunteered were contacted via email and an interview was scheduled. Interviews were conducted face-to-face or electronically depending on location, time, and availability of the participant and researcher. All participants were asked permission to record interviews. The researcher recorded the process and took observational notes using a journal. Interviews with teachers were transcribed and the transcriptions were forwarded to participants for their review.

Ethical Considerations

Approval from the Brandman University Institutional Review Board (BUIRB) was obtained prior to conducting the study. Approval required understanding of ethical standards in dealing with human subjects, including respect for others, benevolence, and fairness. All participants were provided adequate time to review the informed consent

form (Appendix C) and consider all options. The researcher thoroughly explained the study purpose, procedures, potential benefits and risks, and the voluntary nature of their participation. Participants were assured confidentiality protocols would be followed so all identifiable information was protected. Participants had the right to withdraw from the study without penalty or refuse to answer any questions at any time without repercussions. The researcher ensured participants comprehended all the information presented. Additionally, the researcher responded to any questions surfaced.

Assurance of confidentiality included processing the dissertation proposal through the BUIRB. BUIRB approval necessitated researchers conducting studies involving human subjects to submit research protocols to the BUIRB for review and approval prior to commencing the project. The necessary documentation was submitted to BUIRB and the study was approved to move forward. After BUIRB approval, data collection commenced.

Data Analysis

To distinguish the patterns in participant responses, it was important to analyze emerging themes of consensus and disagreement relevant to the research questions. The data produced from the survey described participant ratings about technology integration. McMillan and Schumacher (2010) proposed using a survey for research provided clarity on the participants viewpoint. The quantitative data produced from the questionnaire was analyzed using descriptive statistics and reported in tables. Qualitative data were analyzed using a spreadsheet, creating themes and color coding.

Quantitative Data Analysis

As explained by McMillan and Schumacher (2010), descriptive explanatory data were used to, "describe and explain the patterns related to the phenomena" and "to examine new or little-understood phenomena" (p. 324). Likert scale data were gathered and used to assess the frequency of usage and specific practices used by participants. Data were categorized to refine questions and used to provide a framework for further conceptualization of qualitative data. The purpose of survey questions 2 to 20 was to identify and narrow the best practices most used by technology integration experts in middle school classrooms. For survey questions 4 to 12, participants were asked to identify which practices and technology applications they used. Similarly, questions 13 to 20 asked participants to rate on a Likert scale from 1 (low importance) to 5 (high importance) what they perceived as most important for successful middle school technology integration. Participants were instructed to identify strategies in the first section and rate them on the scale of 1-5 on questions 13 to 20. The number of respondents marking each rating was tallied and a mean score was calculated. The items were rank-ordered to identify the most important practices.

Qualitative Data Analysis

For survey questions 21 to 25, participants were asked open-ended questions to provide more detail and explanation about their technology integrated leaning activities. Additionally, interview participants were asked open-ended questions to learn more about successful technology integration practices using a standard protocol (Appendix D). Interview recordings were obtained, transcribed, and coded where patterns and identifying themes were noted. Coding allowed the researcher to find similarities

among transcribed data developing categorical information sections (McMillian & Schumacher, 2010). Data categories assisted the researcher in addressing the research questions.

The researcher, with the assistance of Excel and Google Docs coded the data. The transcribed data from the survey instrument was uploaded to Excel software using participant numbers to safeguard confidentiality. Use of interview data provided a fuller understanding of best practices and the themes that emerged.

Limitations

Limitations are elements that could adversely affect a study and limit the researcher's ability to generalize to other populations (Patton, 2002). One study limitation was the use of purposeful convenience sampling, which was not random, so the data may not generalize to others outside of this study. Also, a small sample of experts in middle school technology integration were surveyed and interviewed. The sample size was limited and may affect generalizability. Another limitation was whether participants responded in a truthful and accurate manner during data collection. A fourth limitation was the use of excerpts of survey instruments from publish dissertations, which could limit the scope of information provided from participants. Furthermore, the study was conducted with middle school teachers in northern California and, therefore, the findings may not be able to be generalized to other geographical areas either nationally or globally. Finally, a limitation of the study was the researcher acted as the instrument of inquiry for the interviews, which could influence the research results.

Summary

Chapter III detailed the methodology used in this study, reviewed the research questions, and presented study processes. The purpose of this study was to gather ideas about best practices in technology integrated classrooms based on experts at technology integration in middles school. Quantitative data were gathered using an electronic survey and qualitative data were collected via interviews. Descriptive statistics were used to analyze quantitative data. Qualitative data were coded and analyzed for trends in the degree of technology integration used. Chapter IV describes the findings and how the information can be used for deeper learning. It also discusses the barriers of successful implementation of technology integration in middle schools based on the teacher experts.

CHAPTER IV: RESEARCH, DATA COLLECTION, AND FINDINGS

Technology in the classroom changed rapidly over the last decade. These changes forced educators to make decisions regarding instructional practices in conjunction with the use of technology to ensure the greatest impact on deeper learning environments (Fullan & Donnelly, 2013). The question was not whether to use technology, but rather how technologies should be used to support instructional outcomes (Javeri & Persichitte, 2007). In studies to identify technology and its effectiveness findings revealed both positive and negative effects of technology integration with minimal data that identified and described teacher best practices or experiences in middle school classrooms (Adcock, 2008). Therefore, the purpose of this study was to identify and describe best practices in and barriers to technology integration in middle school classrooms as perceived by expert middle school teachers.

Chapter IV reiterates the purpose statement, research questions, population, sample, and methodology. It includes a review and an analysis of the data describing teacher responses on quantitative and qualitative interviews. Data pertaining to research questions are presented in table format to describe survey responses. Interview data are provided in a narrative format and arranged in themes describing practices of technology integration in middle school classrooms.

Purpose Statement

The purpose of this mixed methods sequential explanatory study was to identify and describe best practices in technology integration in middle school classrooms as perceived by expert middle school teachers. Additionally, it was the purpose of the

study to determine the most important best practices and perceived barriers to successful technology integration as perceived by expert middle school teachers.

Research Questions

1. What are the best practices in technology integration in middle school classrooms as perceived by expert middle school teachers?
2. What are the most important best practices in technology integration in middle school classrooms as identified by expert middle school teachers?
3. What are barriers to successful technology integration in middle school classrooms as perceived by expert middle school teachers?

Methodology

This mixed methods sequential explanatory study included a survey of middle school teachers in five northern California schools who were identified by their superintendents and/or principals as experts in technology integration by meeting the criteria outlined in Chapter III. Thirty-four teachers responded to the survey and some teachers indicated their willingness to complete a follow-up interview. Of the 34 survey participants, two did not answer most of the questions despite clicking through the entire survey resulting in an n of 32 for most items. Likert scale data were gathered from the initial survey instrument and used to assess the frequency of usage and specific practices used by expert technology integration teachers in middle school. The researcher categorized the data to identify common themes using Excel, followed by reporting information gleaned in data tables shown in this chapter.

Based on the survey participants response when asked if they were willing to be contacted further to participate in a follow-up interview, 12 willing participants were

contacted to complete interviews. Seven teachers participated in interviews; some were unable to participate due to schedule conflicts or other extenuating circumstance even though they expressed willingness. Three of the interviews were completed face-to-face, three were completed over the phone, and one was completed virtually. Interviews were transcribed and forwarded to participants for review, corrections, and confirmation of accuracy. Initial coding was completed by writing notes on transcripts. Then, transcripts were coded using NVivo and analyzed for themes, possible trends, and commonalities.

The sample for this study of expert middle school teachers met the following criteria:

- Taught 6th, 7th or 8th grade in a public school located in California within the specified counties
- Spent at least three years in middle school teaching with technology
- Received specific training or certifications in technology
- Held a leadership role in integrating technology, such as lead teacher
- Authored papers or presented at workshops/conferences re: technology
- Confirmed as an expert middle school technology teacher by the principal or superintendent

Presentation and Analysis of Data

This section describes the data gathered from the survey instrument and corresponding interview questions. Data are presented as they align to the research questions. This section details both quantitative and qualitative data that highlight noticeable themes.

Findings for Research Question 1

Research Question 1 asked: What are the best practices in technology integration in middle school classrooms as perceived by expert middle school teachers? To address this question, the survey asked how often participants used technology for instructional purposes and how often their students used technology. Of the 34 participants who completed the survey, 84.4% reported using technology for instructional purposes daily in their class. Surprisingly, three respondents used technology for instructional purposes at least once a week. In terms of students, 14 (45.2%) participants stated they had their students use technology in an instructional setting daily whereas other participants had their students use technology every other day or less (Table 5).

Table 5

Frequency of Teacher and Student Technology Use

	Teacher		Student	
	n	%	n	%
Daily in each class	27	84.4	14	45.2
Every other class	1	3.3	5	16.1
Three times a week	1	3.3	5	16.1
At least two times a week	0	0	3	16.1
At least once a week	3	9.4	6	19.4

Digital citizenship. Participants were also asked to describe best practices they deemed effective for developing student skill pertaining to digital citizenship. Twenty-five of 34 participants (78.1%) stated they provided equitable access to technology for all their students. Additionally, 71% of the expert teachers discussed and modeled the importance of internet safety with students and 21 (62%) identified all five areas as a best practice for modeling digital citizenship (Table 6).

Table 6

Teacher Modeling of Digital Citizenship (ISTE Standard 2)

	n	%
Provide equitable access to technology for all students	25	78.1
Discuss and model the importance of internet safety	23	71.8
Model and teach the safe, legal, and ethical use of digital information and technology	22	68.8
Model and expect students to use appropriate documentation of sources on projects	21	65.6
Discuss and model the importance of copyright and ethical use of digital information with students	21	65.6

With over 50% of respondents identifying modeling appropriate digital use and providing equitable access to technology clearly signified a high level of importance for middle school technology implementation. This was evident from interviews as well. Participant 4 highlighted the importance of discussing digital citizenship with middle school students, saying,

> It is very important to teach students proper use of technology and what it means to be a positive digital citizen. All grades must complete at least three Common Sense Media lessons from the topics internet safety, digital footprint and reputation, and creative credit and copyright. These are done in English classrooms the first 10 days of school.

Use of digital tools and resources. Participants were asked to describe their use of digital tools and resources. Twenty-five participants (78.1%) reported they used email, productivity software (e.g., word processing, spreadsheets, databases, presentation software) and websites for both personal and instructional use. Additionally, 23 participants designed learning activities for students that used productivity software and websites. Interestingly, over half (68%) used staff and student

shared folders and/or a learning management system (LMS) to share teacher designed learning activities (Table 7).

Table 7

Participant Use of Digital Tools and Resources (ISTE Standard 6)

	n	%
Email, productivity software, and websites for personal/instruction use	25	78.1%
Self-designed learning activities for students that use productivity software and websites	23	71.9%
Staff and student shared folders and/or LMS for information sharing and/or collaboration.	22	68.8%
Integrate digital tools and resources for communication, production, collaboration, and instruction	21	65.6%
Digital tools for collaboration with colleagues and/or students	21	65.6%

To seek deeper understanding of how expert technology implementing middle school teachers used digital tools and resources, interview questions asked for further explanation and examples. Participant 4 reported the best practice of seamlessly integrating the use of digital tools and resources for communication, production, collaboration, and instruction was supported by using a LMS. Participant 4 explained,

> Echo is our content management system and LMS… All assignments are provided on the LMS where students access course content, including daily agendas, grades, feedback, and communication applications or email where we can exchange information… I can put every link that I need on our agenda and students can access it in one place.

Interactive technology. Survey participants were asked to select which statement best described their use of interactive technology. Responses showed 59.4% of participants used and created lessons and assessments that engage students through

interactive technologies that advanced student learning and creativity (e.g., interactive boards, wireless devices, individual response systems). Instead of creating their own lessons and assessments, 21.9% used existing lessons and assessments that engaged students through interactive technologies (Table 8).

Table 8

Technology Used Interactively (ISTE Standards 1,2,6,7)

	%
Use and create lessons and assessments that engage students through interactive technologies that advance student learning and creativity	59.4
Use lessons and assessments that engage students through interactive technologies	21.9
Use lessons that engage students primarily through interactive technologies	6.3
Use interactive technology primarily for presentation and working toward interactive use with students	12.5
Use interactive technology primarily for presentation.	0.0

Practices to support learning and assessment. Survey participants were also asked to describe best practices that supported effective learning experiences and assessments. Responses showed 32.3% of participants designed, monitored, and assessed the digital learning environment that enabled students to pursue their individual curiosity. In contrast, 25.8% used digital tools to address diverse learning styles and 19.4% provided customized and personalized learning experiences based on achievement data (Table 9).

Table 9

Support of Student Learning Experiences and Assessments (ISTE Standards 1,5,6)

	%
Provide a digital learning environment where students are active participants in setting educational goals, managing learning, and assessing progress	9.7
Provide a digital learning environment enabling students to pursue individual curiosity	32.3
Provide customized and personalized learning experiences based on achievement data	19.4
Provide digital tools to address diverse learning styles	25.8
Provide learning experiences that incorporate the use of various digital tools	12.9

Technology for research and problem-solving. Participants were asked to select the response that best described how they instructed students to use technology for research and problem-solving. Participant responses showed 51.6% required students to search for and evaluate information through electronic resources and other appropriate technologies exploring real world issues and authentic problems. Approximately 16.1% of expert teachers assigned projects that required students to locate information electronically and give credit by citing sources and another 16.1% assigned questions that could be answered through a search of teacher-selected electronic resources (Table 10).

Table 10

Student Use of Technology for Research and Problem-Solving (ISTE Standards 3,4)

	%
Projects require students to search for and evaluate information through electronic resources and other technologies exploring real world issues and authentic problems.	51.6
Projects require students to locate information electronically and give credit by citing sources	16.1
Students receive questions that require a search of student-selected electronic resources and other appropriate technologies with limited assistance.	9.7
Students receive questions that require a search of teacher-selected electronic resources	16.1
Students are told about electronic resources that relate to topics they are studying	6.5

Use of technology applications. Survey participants were asked to identify technology applications they used with their students. Nearly all (90.6%) had students use the Internet for research. Additionally, 75% or more of expert teachers had students use word processors, games, and presentation software. Between 50% and 65% of participants reported using Excel spreadsheets and Blackboard applications with students. All other uses of technology were noted by fewer than half the respondents (Table 11).

Table 11

Technology Applications Used with Students (ISTE Standards 4,5,6,7)

	n	%
Internet for research	29	90.6
Word processors (Word)	25	78.1
Presentation Software	25	78.1
Games (tutorial and basic skills development)	24	75.0
Spreadsheets (Excel)	21	65.7
Blackboard applications (online testing, wikis, blogs)	17	53.1
Special applications for reading, math (e.g., Accelerated Reader, Larson)	15	46.9
Discovery Education (digital textbooks)	14	43.8
Interactive White Board (SMARTboard, Promethean, graphing)	13	40.6
Databases	11	34.4
Learning management system	11	34.4
Webpage creation	9	28.1
Podcasting / Vodcasting (Audacity, Garage Band, MovieMaker, Photostory)	8	25.0
Graphing calculators	7	21.9
'Clickers' (Class Performance System or Senteo)	3	9.4
CD-ROM encyclopedias	1	3.1
Probes for data acquisition (temperature, mass)	1	3.1
GPS / Geocaching	1	3.1
Webinar (AdobeConnect)	0	0.0
Other (Please Specify)	8	25.0

Participants also had the chance to identify other software applications or tools they used with students. These responses included other LMS platforms, Google Suite, K-12 digital flexbooks, simulator and coding applications, multi-media software, and specific software applications.

Addressing adolescent needs. Survey participants were asked to identify needs of early adolescents they incorporated into their technology integrated lessons. Nearly all (93.8%) incorporated structure and clear limits in their technology integrated lessons. This was followed by competence and achievement (87.5%), creative expression

(84.4%), and positive social interactions with adults and peers (81.3%). Only seven (21.9%) reported incorporating physical activity into their classrooms (Table 12).

Table 12

Adolescent Needs Addressed in the Classroom (ISTE Standards 3,4,5)

	n	%
Structure and clear limits	30	93.8
Competence and achievement	28	87.5
Creative expression	27	84.4
Positive social interaction with adults and peers	26	81.3
Meaningful participation in families, school, and communities	19	59.4
Opportunities for self-definition	19	59.4
Physical activity	7	21.9

Based on the developmental age of middle school students, the participants placed a high importance on establishing structure and clear limits. Interview data further explained what best practices looked like for structure and clear limits. Participant 5 shared,

> Middle school students come to realize they have all this power and they haven't quite yet developed as much empathy as they should for how much power they have when using technology. Therefore, my students, require a lot more boundaries put in place for them from an external factor. Additionally, I put a lot of emphasis on their social responsibility, which is why we did a debate on cyberbullying, focusing on the proper use of social media. This project helped develop positive actions and how we as individuals need to be the ones to ways to constructively use social media.

Similarly, Participant 3 described how structure and clear limits were incorporated in the middle school classroom through learning activities, saying,

Structure and clear limits usually come in the form of an activity or project where students are provided guidelines used to meet learning criteria. Learning expectations are identified, ensuring students know what they're trying to do, what their objective is, how to gather information and use resources to support learning, and provide positive exploration.

Addressing digital generation needs. Survey participants were asked how important it was to incorporate specific digital generation needs into their technology integrated lessons. Responses showed 90.6% of participants used visually or media-rich teaching resources in their technology integrated lessons. Also, 78% to 82% of the expert teachers utilized social-based activities (e.g., cooperative learning, wikis, games), frequent transitions during class, digital literacy (i.e., teaching students how to use software and how to choose valid resources on the internet), and student choice (Table 13).

Table 13

Digital Generation Needs Addressed in the Classroom (ISTE Standards 1,3,4,5)

	n	%
Visually/media-rich teaching resources	29	90.6
Social-based activities	26	81.3
Frequent transitions during class	25	78.1
Digital literacy	25	78.1
Student choice	25	78.1

Participants were then asked how important it was to incorporate specific 21st century skills into technology integrated lessons. Interestingly, responses showed 96.9% placed a high importance on incorporating core content and critical thinking/problem-solving into technology integrated lessons. Also, 93.8% incorporated learning activities

to develop communication skills and 87.5% incorporate learning activities that supported creativity and thinking outside the box. In contrast, only 50% incorporated leadership/accountability and ethics/social responsibility (Table 14).

Table 14

21st Century Skills Addressed in the Classroom (ISTE Standards 1,3,4,5,7)

	n	%
Core content	31	96.9
Critical thinking/problem-solving	31	96.9
Communication skills	30	93.8
Creativity/thinking outside the box	28	87.5
Personal accountability (goal setting and evaluation)	24	75.0
Digital literacy	23	71.9
Leadership/accountability	16	50.0
Ethics/social responsibility	16	50.0

Throughout the survey, participants were asked to identify best practices used in technology integrated classrooms. These data provided a broad overview of best practices used in technology implementation. In the next section, data describes what the participants found most important for technology integration.

Findings for Research Question 2

Research Question 2 asked: What are the most important best practices in technology integration in middle school classrooms as identified by expert middle school teachers? Participants responded using a Likert scale with 1 = *Low Importance* and 5 = *High Importance*.

Digital citizenship. Participants were asked how important specific practices were in supporting student success as it pertained to how teachers modeled digital citizenship. Participants placed importance on all five, with the highest importance

placed on the necessity to provide equitable access to technology for all students (80.0%) and discussing and modeling Internet safety with students (73.3%). Fewer than half of the respondents rated the other items of high importance (Table 15).

Table 15

Importance of Modeling Digital Citizenship (ISTE Standards 1,2,7)

	1	2	3	4	5
Provide equitable access to technology for all students	0.0	0.0	3.3	13.3	80.0
Discuss and model the importance of Internet safety with students	0.0	3.3	6.7	13.3	73.3
Model and expect students to use appropriate documentation of sources on projects	0.0	3.3	16.7	33.3	46.7
Model and teach the safe, legal, and ethical use of digital information and technology	3.3	3.3	16.7	33.3	43.3
Discuss and model the importance of copyright and ethical use of digital information	3.3	0.0	20.0	33.3	43.3

Interviews also asked about digital citizenship. Participant 7 thought equitable access was necessary to support successful technology integration in middle schools, noting,

> As far as providing equitable access to technology, it is essential and why I am such a strong proponent of having equity, especially in technology, for all students. For example, our middle school students [who] typically come from poverty do not have access. They have access maybe to cellular technology, but that's very different than an actual computer. The other reality too is that with our students of poverty, they tend to not have access to the internet at home. They have access at school because all of our schools have free Wi-Fi for students, and they may have it if they go to the

public library, but even then, if they don't have access to a library close to them, they don't have access at home.

Additionally, Participant 1 explained how equitable access was crucial for successful technology integration in middle school, sharing,

> I think the biggest component in regards to digital citizenship, although all the noted factors are important, but really on having equitable access to technology. In one of my classes, I was short 15 computers and this was just last year… We grew to have a one-to-one computing environment. Students were able to check out and borrow computers this year, making a huge difference and seeing the benefits for students to have equitable access.

Participants also placed a high importance on the need to teach students how to be safe in their use of the Internet. Participant 3 described best practices that supported learning activities promoting Internet safety, commenting,

> We believe all of them need to handle technology as a responsible student. We talk about what are safe websites, what legal and ethical boundaries are, and that if they are to go on an inappropriate website, a consequence could have their technology taken away from them, as well as a referral sent home. Other unethical actions on the internet could be in the form of cyberbullying, plagiarizing, and improper citations.

Use of digital tools and resources. Participants were then asked to describe specific practices, digital tools, and resources they used to support student success. Responses showed half (50%) placed high importance on their use of email, productivity software (e.g., word processing, spreadsheet, database, and/or presentation software),

and websites for personal and/or instructional use. As shown in Table 16, half of participants (50%) also placed high importance on using and creating lessons and assessments that engaged students through interactive technologies that advanced student learning and creativity (e.g., interactive boards, wireless devices, individual response systems).

Table 16

Practices Used to Support Student Success with Digital Tools and Resources (ISTE Standards 4,5,6,7)

	1	2	3	4	5
Email, productivity software, and websites for personal/instructional use	0.0	10.0	6.7	33.3	50.0
Lessons and assessments that engage students through interactive technologies to advance learning and creativity	0.0	3.3	16.7	30.0	50.0
Activities that use productivity software and websites	0.0	3.3	20.0	36.7	36.7
Digital tools and resources for communication, production, collaboration, and instruction	0.0	3.3	30.0	36.7	30.0
Shared folders and/or LMS	3.3	10.0	26.7	23.3	36.7

Interview participants echoed the importance of utilizing and creating lessons and assessments that engaged students through interactive technologies. For example, Participant 4 shared,

> Our district uses Google Apps for Education or G Suite for Education. It is a suite of productivity tools to help students and teachers interact seamlessly and securely across devices. The suite includes G-Mail, Calendar, Contacts, Hangouts, Classroom, Drive, Docs, Slides, Forms, Sheets, Drawings.

Google Classroom distributes assignments, sends feedback, and allows me to see everything in one place.

Technology to support student learning. Survey participants were asked how important specific practices were to support student success in meeting learning objectives while using interactive technology. Participant responses of 4 and 5 combined showed over 65% of teachers used interactive technology primarily for presentations and were working toward interactive use in helping students be successful in reaching their learning objective goal. In contrast, approximately 27% of participants used interactive technology primarily for presentations to students (Table 17).

Table 17

Practices to Support Student Success in Meeting the Learning Objectives (ISTE Standards 1,2,6,7)

	1	2	3	4	5
Use interactive technology primarily for presentations and working toward interactive use with students	0.0	17.2	17.2	37.9	27.6
Use interactive technology primarily for presentation	6.9	20.7	37.9	24.1	3.5

Interviews also asked about the use of interactive technology. Participant 4 described using interactive technology, explaining,

> In my class, interactive use is based on a lot of student choice, especially for topics of interest. Additionally, students have the option of choosing the format in which they will share their learning and knowledge. Students can use a paper/pencil tool or digital tool to fulfill the assignment criteria.

Supporting student learning and assessment. Survey participants were asked how important specific practices were in support of effective student learning experiences and assessments. Responses showed over 75% of participants rated designing a digital learning environment where students were active participants in setting their own educational goals, managing their learning, and assessing their own progress of strong or high importance. Additionally, 83.3% placed a strong or high importance on designing, monitoring, and assessing the digital learning environment that provided experiences to enable students to pursue their individual curiosity (Table 18).

Table 18

Practices in Support of Effective Student Learning and Assessments (ISTE Standards 1,5,6)

	1	2	3	4	5
Design a digital learning environment where students are active in setting their own educational goals, managing their learning, and assessing their progress	0.0	3.5	20.7	31.0	44.8
Design, monitor, and assess the digital learning environment that provides experiences that enable students to pursue individual curiosity	0.0	0.0	16.7	50.0	33.3
Design customized and personalized learning experiences based on achievement data	0.0	3.5	13.8	34.9	48.9
Design learning experiences using digital tools to address diverse learning styles	0.0	3.3	20.0	40.0	36.7
Design learning experiences that incorporate the use of various digital tools	0.0	6.7	13.3	40.0	40.0

Interviews asked participants to elaborate on design of learning environments. Participant 4 placed a high importance on being able to design, monitor, and assess the digital learning environment, sharing,

> When students are engaged and interested in material, learning is easy. Students want to learn and will work through any situation that is difficult

because they have more ownership of what they are learning. This interest drives their learning and creates curiosity to continue learning even after an assignment might be complete.

Participant 7 explained how he designed learning experiences using digital tools to address diverse learning styles, noting,

> We have so many students that are at different places… Probably half of those students, if we had a middle school honors track, would be in that class. The other half are still learning English… I have in that class five students who are speaking Farsi or Dari languages coming out of Afghanistan, and they're still learning English, but they're probably realistically at about maybe a second grade reading level. When I give them readings online, their reading is coming from a different place than my students who are in the honors track. Those honors track students, I'm giving them the online textbook… I tend to kind of see where they're at educationally and try to build things that will really fit for them.

Research and problem-solving. Survey participants were asked how important specific practices were to support student success in using technology for research and problem-solving. Data showed 83.3% of participants rated assigning projects that required students to search for and evaluate information through electronic resources and other appropriate technologies to explore real world issues and authentic problems as strongly or highly important. Additionally, approximately 72% of the participants placed a strong or high importance on assigning projects that required students to locate information electronically and give credit by citing sources (Table 19).

Table 19

Technology for Research and Problem-Solving (ISTE Standards 3,4,5)

	1	2	3	4	5
Assign projects that require students to search for and evaluate information through electronic resources and other appropriate technologies exploring real world issues and authentic problems	0.0	3.3	13.3	43.3	40.0
Assign projects that require students to locate information electronically and give credit by citing sources	0.0	6.7	20.0	36.7	36.7
Assign questions that can be answered through a search of student located electronic resources and other appropriate technologies with limited assistance	0.0	6.7	26.7	43.3	23.3
Assign questions that can be answered through a search of teacher-selected electronic resources	3.3	23.3	33.3	36.7	3.3
Show students electronic resources that relate to topics they are studying	0.0	13.3	30.0	36.7	16.7

Interviews asked participants to expand on how they used technology tools for research and problem solving. Participant 6 explained technology integration supported student success, sharing,

> One example of a learning activity where students have to use electronic resources to solve a problem is when they are asked to compare a snail's speed to the speed of an aircraft… They need to use the internet and research to find the average speed of a snail and the average speed of the specific aircraft… Comparing the speed of a snail to the speed of an aircraft is not totally real world, but it's real world data that they are trying to find and are evaluating.

Another example of how participants provided research resources to solve problems came from Participant 5, who explained,

> Students had to research social media to prepare for a debate… I gave them resources like ProCon.org and Newsela, which would provide developmentally appropriate curricula and user-friendly access at the middle school level. Students were given a graphic organizer to fill out where to compile their data and organize their citations identifying where they obtained their information from and how they also had to evaluate the validity of the information.

Participant 1 also shared an example that required students to search for and evaluate information through electronic resources,

> They're working on an individual project right now called Genius Hour. They have their own driving question, their own research question, and we're doing a complex task format. Task format is where they're designing their own tasks and following through with different benchmarks to show how they are completing the project and communicating their process. Students must find the information and find out if it's valid completely working on their own. They're checking in with me as needed, but this is really a self-led, self-motivated inquiry project. They're going in and they are doing this research on their own to address real world issues.

Participant 3 shared an example that required students to search for and evaluate information through electronic resources and other appropriate technologies exploring real world issues and authentic problems, commenting,

> In math, they use technology for research and problem-solving related to climate change. It has to do with distances traveled and CO_2 emissions.

> Driving question is how much CO_2 emission would it take for you to walk from your house to school versus how much would it take for you to ride the bus from your house to school, and then divide it by all the people on the bus, and/or driving to school in a certain car that has certain miles per gallon… Students needed to find their house, the distance from their house to school. From there, students needed to calculate ratios to figure out how much carbon dioxide is being omitted. The next step was students had to compare how temperature could affect CO_2. That's problem solving, getting integrated into the research.

Addressing adolescent needs. Participants were asked about how they met student adolescent needs through technology integrated lessons. Participant responses showed 90% provided strong to high importance (rating of 4 or 5) to establish structure and clear limits in a technology integrated lesson. Additionally, 96.7% placed a strong to high importance on incorporating competence and achievement into their technology integrated lesson (Table 20).

Table 20

Addressing Needs of Adolescents (ISTE Standards 2,5)

	1	2	3	4	5
Structure and clear limits	0.0	3.3	6.7	13.3	76.7
Competence and achievement	0.0	3.3	0.0	36.7	60.0
Positive social interaction with adults and peers	3.3	3.3	10.0	26.7	56.7
Meaningful participation in families, school, and communities	0.0	6.7	10.0	43.3	36.7
Opportunities for self-definition	0.0	10.0	16.7	33.3	40.0
Creative expression	0.0	3.5	20.7	44.8	31.0
Physical activity	13.3	6.7	36.7	26.7	13.3

The data indicated the most important best practice to meet the needs of adolescent students was to provide structure and clear limits in a technology integrated lesson or learning activity. This was consistent with interview data. Participant 2 explained structure and clear limits set expectations, sharing,

> The atmosphere in the classroom in all my classes is strict in the way that I set clear expectations. An example is that I expect everyone to get along. I tell them that it does not matter who you sit by, you can't say, "Oh, yay," or, "Oh, no." You can't say either because you don't know how someone would interpret that… I have to know that they can work with anybody.

Interview Participant 1 explained structure and clear limits in her classroom as follows,

> I always work on structure and clear limits; I strive to find what will work best. This year, using Google Slides has helped set expectations… Students knew to look at slide and get set up for whatever that first slide said. That has really helped with some expectations. Routine also helps with structure and clear limits. Examples are how students know every day there's a warm-up when they come in the door, they know that on a test day there's time to study and the test starts. These class norms provide clear expectations and structure, which middle school students need.

However, participants responses also supported a high level of importance for competence and achievement to be incorporated into technology integrated lessons. Additionally, participant responses included moderate to high levels of importance in positive social interactions with adults and peers; meaningful participation with family,

school, and community; opportunities for self-definition; creative expression, and physical activity. Participant 4 described how she met adolescent needs, noting,

> Middle school students are very social by nature, so incorporating academic discourse using sentence stems and discussion protocols is essential. I also have students working in partners and/or groups frequently. By incorporating collaboration and discussion protocols, students partake in more positive social interactions. When it comes to creative expression, I always try to incorporate some form of student choice into my lessons. Most of the work in my class does not have a single correct answer, but many acceptable answers if students use evidence to defend the answer. This allows students to think critically, but also creatively.

Addressing the needs of the digital generation. Survey participants were asked to provide their input on the importance of incorporating the specific needs of the digital generation into technology integrated lessons. Participant responses showed 82.8% deem a strong to high importance (rating of 4 or 5) to incorporating visually and media-rich teaching resources in technology integrated lessons. Additionally, 73.4% placed a strong to high importance on incorporating digital literacy (Table 21). Digital literacy included showing students how to use software and/or how to choose valid resources on the internet and necessitated integrating mini-lessons where students could learn how to use the technology.

Table 21

Addressing the Needs of the Digital Generation (ISTE Standards 1,6)

	1	2	3	4	5
Visual/media-rich teaching resources	0.0	6.9	10.3	48.3	34.5
Digital literacy	0.0	6.8	20.0	46.7	26.7
Student choice/flexible curriculum with interests	0.0	10.3	24.1	44.8	20.7
Frequent transitions during class	0.0	14.8	33.3	33.3	18.5
Social-based activities (cooperative learning, wikis)	0.0	10.0	33.3	40.0	16.7

Participants were asked how important it was to incorporate specific 21st century skills into technology integrated lessons. Participant response showed 92.3% placed a strong to high importance (rating of 4 or 5) on incorporating core content into lessons. Additionally, 93.3% placed a strong to high importance on incorporating critical thinking and problem-solving activities (Table 22).

Table 22

Addressing 21st Century Skills in the Classroom (ISTE Standards 3,5,7)

	1	2	3	4	5
Core content	0.0	0.0	7.7	11.5	80.8
Critical thinking/problem-solving	0.0	0.0	6.7	23.3	70.0
Communication skills	0.0	0.0	18.5	18.5	63.0
Creativity/thinking outside the box	0.0	0.0	20.0	26.7	53.
Personal accountability (goal setting and evaluation)	3.3	0.0	16.7	33.3	46.7
Digital literacy	0.0	0.0	20.0	36.7	43.3
Leadership/accountability	0.0	6.9	17.2	41.4	34.5
Ethics/social responsibility	0.0	0.0	33.3	36.7	30.0

Interview participants were asked to give examples of how they used technology, what made it successful in both student engagement and competence/student achievement, and how they knew it was successful, as well as describe the technology

tools used and what skills students needed to learn to use tools. Participants provided many examples and descriptions of engaging, successful technology integration lessons and learning activities in different content areas. They provided many examples, some similar and some different and varied based on the learning activity. Regardless of the tool used, many key findings or common themes stood out.

Participants were asked to describe one of their most successful technology integrated learning activities. Most used presentation/production software. This was followed by online simulation learning activities and research and inquiry projects. Other themes that emerged were the use of technology games, creating videos, and coding. Table 23 presents the themes along with sample quotations.

Table 23

Most Successful Technology-Based Lesson/Learning Activity

Major Themes	Example Quotations
Presentation/Production Software -Google, Canva, Pear Deck, other (n=11)	• Students use Google Docs to collaborate, provide feedback, create slides, citations, visual model • Use websites or blogs to publish work • Use PowerPoint, Prezi, and/or eBook to tell a story from a new viewpoint
Online Simulation (n=8)	• Students demonstrate mastery of standard through online simulation • Complete simulation for content, comparing data, & drawing conclusions • Graphing with engineering applications
Research/Inquiry (n=5)	• Students research famous people who have had life struggles yet used their positive character to overcome obstacles • Students answer relatable inquires through project-based learning that requires research, collaboration, and authentic global sharing opportunities
Technology Game (n= 4)	• Technology based game to give background, students find clues and discuss possible answers with peers • Math games as a resource for free play and for documented achievement of skills in a self-paced situation • Create video game as a possible career choice
Create Video (n=3)	• Students create a video reflection and post what they learned on Seesaw • CSPAN Project where students make a 5-7-minute documentary • Students learn to program robots and make stop motion videos
Coding (n=3)	• Teach students how to code to automatically calculate and update based on given information • Coding to create a video game

Note: n=number of survey participants who responded with similar theme

Participants were then asked to explain why they thought the learning activity was so successful. Participants explained the lessons were engaging to middle school students. Engagement was the top reason participants identified as to why lessons were

successful. Additional themes that emerged included because students were interested in the content/project, it was fun or unique, it provided student choice, it had real world relevance (meaningful purpose), it provided opportunities for group work and collaboration, or it was hands-on. Table 24 presents the themes with sample quotations.

Table 24

Reasons for Successful Technology Integrated Lessons

Major Themes	Example Quotations
Engaging (n= 9)	• The students are engaged because they had the opportunity to do something different • It allowed them to interact in a new and exciting way • Students are engaged because they work at their own pace, answer a question for themselves and have something to show off at the end
Authentic, real world, relevant, relatable (n=8)	• Publishing work online creates an authentic audience, but there should also be an authentic purpose as well. • It was relevant to them and gave them an opportunity to teacher others about one of their passions and something of great importance to them. • It is very real world, problem-based
Student Choice(n=6)	• It is fun, unique, and lets them choose their subject and interest • Students use math and science skills learned and provides personal choice of presentation of information • It improves their engagement by allowing them to participate in academic discourse that involves their subject of choice while still meeting the learning objective
Collaborative (n=4)	• They were using a media they were interested in and had to work collectively. • They had the opportunity to further explore something that captured their interest and share their excitement with others. They also like giving and receiving feedback. The positive and supportive posts from parents are great, too. • Middle school students love to have control over their learning and work with others in a social setting during learning.
Interactive, Hands on (n=3)	• Interactive and engaging. • Students learn by trial and error and doing this activity (disguised as a game) allows them to try things digitally that would be impossible with pencil and paper.

Note: n=number of survey participants who responded with similar theme

Participants were asked how they judged a learning activity on its effectiveness in relation to student achievement. Themes that emerged included rubrics, quizzes and/or student responses, student ability to explain their leaning, and project completion. Table 25 presents the themes along with sample quotations.

Table 25

Judging the Effectiveness of Lessons based on Student Achievement

Major Themes	Example Quotations
Rubric (n=7)	• We used a New Tech Network rubric and the requirements set by the CSPAN news organization • Student achievement was measured based on grade level standards and whether they were able to prove their learning with evidence that was credible and cited in MLA format • I expect to see multiple drafts of writing assignments, and I keep track of my student's progress throughout the assignment to see their growth. All along the way, they are evaluating their own writing and their peer's writing against a rubric
Quiz/Respond to Questions (n=7)	• Monitor their screens, quizzes from the assignment, or performance tasked that they complete online • Asking them about how thermal energy affects particles on a quiz and to explain why particles move faster when something solid starts to melt
Explain, Describe, Essay (n= 5)	• Could they explain the phenomenon • I find it effective for determining how well students understood content from class and seeing where gaps in knowledge may be based on how they are describing what they have learned • They wrote a narrative essay, used citations with research, and students gave presentations
Completion of Project (n=3)	• You can see how much they've learned by viewing their final products • The project model is used through the year with much scaffolding at the beginning and at the end of the year they have a solo project. I teach in a low economic area and school is the only place students can explore technology. This will help them compete with their peer • Student engagement, feedback, percentage of completion of the assignments and timeliness of completion.

Note. n=number of survey participants who responded with similar theme

Participants were asked to describe the technology tools used and what purpose they were used for in their most successful. Google applications was a common tool used by most participants. Other themes that emerged included interactive computer applications, hyper docs, hardware (e.g., video cameras, robots), and laptops (Table 26).

Table 26

Technology Tools Used for their Most Successful Lesson

Major Themes	Example Quotations
Google Applications (n=15)	• Google slides and online resources. Google allows for access at school and at home/library • Students have created presentations of data through Google Forms and Google Slides, have published findings through Google Sites and Google Docs, and have researched through Newsela and Boolean search strategies on Google • The primary tool used is Google Sheets. It is used to speed up the time intensive process of calculating compound interest, to practice the mathematical process, and to build digital literacy with a commonly used digital tool
Interactive Computer Applications (n=12)	• Quizlet for flashcards and Quizlet live for games • Kahoot used for games and review of information • Qwizdom remotes for lectures or games • PhET simulation to show students digitally how particles react to thermal energy. This was accompanied with a lab experiment the conducted in class
Hyperdoc, Research Applications (n=7)	• Research links provided (credible sources). • Internet research, library database access for research, presentation software, multimedia platform for eBook • Teacher created hyperdoc template to showcase learning
Computer Hardware (n=7)	• Smartboard for presentations, reading, quizzes, test review • VR headsets for engagement • iPad and phones were used to create videos and green screens to make stop motion videos
Laptops, Chromebooks, personal devices (n= 6)	• Students each had a laptop and I was able to view their answers on my computer as they answered • Each student has their own laptop • Class set of Chromebooks to access the technology

Note: n=number of survey participants who responded with similar theme

Participants were asked to explain the skills they needed to teach to use the technology. The most common answer related to expectations and appropriate use. Participants also described teaching students how to use technology applications in general, Google applications, and hardware (Table 27).

Table 27

Skills Taught to Students to use Technology

Major Themes	Example Quotations
Expectations, appropriate use (n=10)	• Clear expectations, communication with peers, and technological benefits of exploring a text • Students needed to know what was appropriate to post for their audience. We also continue to work on giving meaningful feedback to peers. • Critical thinking skills, how to identify credible sources, purpose of hyperdoc, how to use correct citations
How to use Technology Applications (n=9)	• Writing a digital script • Coding, web design • 5-minute lesson on technology that was going to be used for lesson
How to use Google Applications (n= 7)	• Use of different Google tools, Google slides, Google Doc addon • How to sign in and use a Google document • I had to teach them how to use Google sheets
Proper use of Computer Applications & Hardware (n=4)	• How to log into a program • Operate, turn on and off the computer, logging on to Internet and websites • How to run certain programs

Note: n=number of survey participants who responded with similar theme

Findings for Research Question 3

Research question 3 addressed the questions of barriers, with survey questions asking what extent specific barriers impacted their ability to teach technology integrated lessons. The top three responses to barriers having a high impact, noted by at least half the respondents, were lack of technology resources such as hardware or software (59.3%), lack of funding to implement technology (57.1%), and large class sizes

(50.0%). Two more barriers with over 40% of participants rating them as having a high impact were not having enough time for learning and implementing new technology (46.4%) and insufficient internet connectivity and bandwidth (42.9%). Other barriers were reported as having a lesser impact on integrating technology (Table 28).

Table 28

Barriers to Integrating Technology into Teaching and Learning

	No Impact	Little Impact	Some Impact	High Impact
Lack of technology resources (hardware, network, and/or software)	3.7	11.1	22.2	59.3
Inadequate funds to implement instructional technology	0.0	7.1	32.1	57.1
Large class size	3.6	10.7	28.6	50.0
Not enough time for learning and implementing new technology	7.1	10.7	32.1	46.4
Insufficient internet connectivity (bandwidth)	0.0	28.6	25.0	42.9
Inadequate support (training or staff at the school)	3.6	14.3	39.3	39.3
Issues with software compatibility and availability	14.3	17.9	35.7	28.6
Insufficient professional development for teachers	3.6	21.4	42.9	25.0
Unrealistic expectations by administrators	17.9	21.4	25.0	25.0
Not enough class time for students to be at computers (master scheduling)	21.4	14.3	32.1	21.4
Lack of student competency and skills	14.3	28.6	39.3	14.3
Inadequate reward structure, including compensation, incentives, etc.	14.3	32.1	32.1	10.7
Lack of recognition	35.7	25.0	14.3	7.1

Data from interview follow-up questions aligned with the top five barriers from the survey, lack of technology resources, inadequate funding, large class size, limited time for learning and implementing new technology, and insufficient connectivity. Interview Participant 1 explained,

> [Bandwidth] was incredibly frustrating. That was probably the worst barrier because it did not provide enough technology for everyone. The unreliable wi-fi did not allow for technology to be used consistently. Next, I would say not enough time for learning and implementing new technology… And then I'm not comfortable introducing that to my students if I don't really feel well-versed in it. Those would be the top barriers.

When asked how the barriers could be overcome, Participant 1 shared,

> Fix the bandwidth. Put in time and energy to improving that, through funding and resources. Next, provide students access to their own use of technology. Provide an option where students can check out laptops or Chromebooks. Students will then feel like they have equitable access. Next, as far as not enough time, develop time in the day for professional learning and provide leaders to support teacher growth.

Participant 1 explains above how bandwidth was a detriment to successful technology integration, but with the right advocacy and funding it was correctable. However, the barrier of time to learn technology was a constant struggle. Participant 4 echoed this sentiment, sharing,

> I am also a person who likes to learn and is always playing. Most teachers are not like this and they are scared to take chances. Therefore, I feel the answer that would fit most teachers would be there isn't enough time for learning and implementing new technology. Many teachers need trainings and then follow-up support to make things work.

As evidenced by participants, the barrier of not having enough time was an ongoing challenge.

Summary

This chapter examined the results of a mixed methods sequential explanatory study focusing on three research questions. Survey questions and interview data helped highlight best practices in technology integration in middles schools, determine the most important best practices, and identify barriers to technology integration. Chapter V addresses major findings from the data, unexpected findings, recommendations for further areas of study, conclusions, implications for actions, and researcher reflections.

CHAPTER V: FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This dissertation began in Chapter I with an introduction of the background and rationale. Chapter II presented a review of literature presenting information regarding technology integration, middle schools, and the unique sociology of middle school students. Chapter II also provided information on the International Society for Technology in Education (ISTE) standards and barriers to technology implementation. Chapter III detailed the study's design and methodology. Chapter IV presented the results of the data analysis in the form of tables and anecdotes. Chapter V provides a summary of the findings, then delves into conclusions and implications for action, as well as recommendations for further research.

Purpose and Research Questions

The purpose of this mixed methods sequential explanatory study was to identify and describe best practices in technology integration in middle school classrooms as perceived by expert middle school teachers. Additionally, it was the purpose of the study to determine the most important best practices and perceived barriers to successful technology integration as perceived by expert middle school teachers. The research questions posed were:

1. What are the best practices in technology integration in middle school classrooms as perceived by expert middle school teachers?
2. What are the most important best practices in technology integration in middle school classrooms as identified by expert middle school teachers?
3. What are barriers to successful technology integration in middle school classrooms as perceived by expert middle school teachers?

Methodology

This mixed methods sequential explanatory study included a survey sent to 34 middle school teachers in five northern California counties who were identified by their superintendent and/or principal as experts in middle school technology integration and met the definition of an expert teacher for this study. The expert criteria consisted of teachers who (1) taught sixth, seventh, or eighth grade within the specified northern California counties of Contra Costa, Marin, Napa, Sacramento, and Solano; (2) had at least three years middle school experience teaching with technology; (3) had specific training or held certifications in technology; (4) held a leadership role in integrating technology; (5) served as a lead teacher, authored papers, or presented at workshops or conferences on technology integration; and (6) were confirmed as an expert of technology integration by their principal or superintendent. Likert scale data were gathered from an initial survey instrument and used to assess frequency of usage and practices used by expert middle school teachers. The researcher conducted interviews following completion of the survey instrument with seven experts who volunteered by providing their contact information on the survey instrument. The intent of the survey and interviews was to identify and describe best practices and most important practices of middle school technology integration, as well as barriers to successful technology integration. The data collection and analysis led to the major findings described in the following section.

Major Findings

The most significant outcome of this study was the ranked compilation of the most important best practices for technology integration in middle schools. In today's

world, technology is pervasive; recognizing and including this in making education relevant to students as they grow and prepare for the future is vital. Identifying best practices regarding technology integration effective for middle school classrooms is a necessity (Simmons & Blythe, 2008; Strahan et al., 2009; Tanner, 1973). Petty (2012) noted technology was a successful avenue to meet middle school student needs and help them be more engaged when used effectively. The findings from the literature were validated in the current research and are presented here in alignment with the ISTE student standards, followed by additional findings about engagement and barriers.

Finding 1: Best Practices Regarding Empowered Learner, ISTE Standard 1

ISTE Standard 1 emphasizes students learn skills and qualities to become an empowered learner. The standard describes empowered learners as students who leverage technology to take an active role in choosing, achieving, and demonstrating competency in their learning goals. Experts at technology integration in middle school rated the following best practices of high importance for developing student skill pertaining to empowered learners:

1. Design customized and personalized learning experiences based on achievement data
2. Design a digital learning environment where students are active participants in setting their own educational goals, managing learning, and assessing progress
3. Design, monitor, and assess digital learning environments to provide experiences that enable students to pursue their individual curiosity

A preponderance of participant responses from the open-ended survey questions supported empowering learners through well-designed activities where students explore something that captures their interest with scaffolded guidance. From the literature, Hattie (2012) described this as visible teaching and learning, meaning the teacher made clear what was being taught and the students understood what they need to do and how to accomplish it. This principle of visible teaching and learning needs to be consistently present in the classroom during technology integration (Fullan & Langworthy, 2013). The literature indicated digital resources that engage and appeal to student developmental needs give students a voice and choice (New Pedagogies for Deeper Learning Global Partnership, 2014). Students need to become contributing participants in the learning design as goals are set, which ensures learning outcomes are clear and processes involved to reach goals are attainable and understood (Lenz & Kingston, 2016). The data from the study aligned with the literature in underscoring the importance of best practices of designing effective learning environments to develop empowered learners.

Finding 2: Best Practices Regarding Digital Citizenship, ISTE Standard 2

ISTE Standard 2 emphasizes digital citizenship development where students recognize the rights, responsibilities, and opportunities of living, learning, and working in an interconnected digital world, and they act and model in ways that are safe, legal, and ethical. Participants rated the following best practices of high importance for developing student skill pertaining to digital citizenship:

1. Provide equitable access to technology for all students
2. Discuss and model the importance of internet safety with students

3. Model and expect students to use appropriate documentation of sources on projects

One of the open-ended survey question asked participants what skills middle school teachers needed for the students to be successful. Most middle school teacher experts stated setting clear expectations, modeling, and offering ongoing guidance of appropriate use of technology were essential. Literature supported this finding wherein Fullan and Langworthy (2014) stated it is fundamental to provide clear, explicit use of how to apply and use technology to accelerate learning. The literature together with the survey and interview data create strong support and evidence for Finding 2.

Finding 3: Best Practices Regarding Knowledge Constructor, ISTE Standard 3

ISTE Standard 3 emphasizes student ability to critically curate a variety of resources using digital tools to construct knowledge, produce creative artifacts, and make meaningful learning experiences for themselves and others. Participants supported students in developing effective knowledge construction and innovative design by developing lessons using problem-solving and real-world issues relevant to students and providing opportunities for students to explore issues and ideas through well-developed research tools. Participants rated the following best practice of high importance for construction of student knowledge:

1. Assign projects that require students to search for and evaluate information through electronic resources and other appropriate technologies exploring real-world issues and authentic problems

Several responses from the survey's open-ended questions cited the best practice of incorporating a variety of technology applications infused with project- or problem-

based learning supporting student-centered inquiry activities. According to Killen (2007), Taylor (2014), and Tileston (2011), providing learning interactions that mirrored a real-life situation endorsed authentic realistic learning. Other sources stated technology integration must happen across the curriculum in ways that deepen and enhance the learning process through interactive research and project- or problem-solving learning activities (Petty, 2012).

Finding 4: Best Practices Regarding Innovative Designer, ISTE Standard 4

ISTE Standard 4 focuses on cultivating students to use a variety of technologies within a design process to identify and solve problems by creating new, useful, or imaginative solutions. Best practices of participants developing innovative designers supported students through having equal access to a variety of technologies to design artifacts, constructing new information, and working through a design process that empowers critical thinking and communication of prototypes to share information. Expert teachers did this by assigning projects requiring students to search for and evaluate information through appropriate technologies to explore real-world issues and authentic problems.

As noted from participants, most important best practices in developing innovative designers included engaging students in core content. Participants thought students were engaged in the lesson or activity because it was: an interesting project, fun, unique, student-selected, real-world, collaborative, interactive, hands-on, or game-like. Students connected to the activity when such characteristics were present. Participants rated the following best practices of high importance for developing innovative designers:

1. Assign projects that require students to search for and evaluate information through electronic resources and other appropriate technologies exploring real-world issues and authentic problems
2. Use technology applications supporting student-centered inquiry, such as:
    a. Presentation/production software
    b. Online simulations
    c. Research/inquiry
    d. Technology games
    e. Creation of games, videos
    f. Coding

Responses from the survey's open-ended questions showed participants incorporated a variety of technology applications project- or problem-based learning. Based the list provided by participants and validated in the literature, interactive learning applications need to support student interest through authentic, real-world issues relevant and relatable to student lives (Erle, 2002; Ertmer; 2005; Marzano, 2015). The data from this study aligned with the literature wherein it middle school students need interactive learning environments for effective middle school technology integration that sustains a climate and culture for learning through differentiated tools and strategies.

Finding 5: Best Practices Regarding Computational Thinker, ISTE Standard 5

ISTE Standard 5 focuses on the skills and qualities needed to be a computational thinker who can develop and employ strategies for understanding and solving problems in ways that leverage the power of technology to develop and test solutions. Middle school experts at integrating technology supported ISTE Standard 5 through best

practices that incorporated technology applications to support early adolescent needs and the needs of digital natives. This included 21st century skill development using a variety of technology tools and thinking processes. Best practices supporting ISTE Standard 5 included selecting technology applications used with students, incorporating early adolescent needs into technology integrated lessons, incorporating the needs of the digital generation into technology integrated lessons, and incorporating 21st century skill development into technology integrated lessons.

Expert middle school teachers of technology integration rated the following best practices of high importance for computational thinking wherein students formulated problem definitions to find solutions, collected data and applied relevant use of data, broke problems into parts to understand automation and algorithmic thinking, and developed a sequence of steps to create and test solutions. Participants best practices facilitate computational thinking skills through the following examples:

1. Use of visual- and media-rich teaching resources
2. Social-based activities (e.g., cooperative learning, wikis, games)

Data obtained from open-ended survey questions showed a large percentage of participants utilize a variety of visual- and media-rich teaching resources that support student thinking and development. Software examples given by participants included Google applications, Canva, Windows applications, Pear Deck, Prezi, ebooks, and video/gaming development programs. Additionally, a sizeable number of expert middle school teacher participants designed their learning environment to incorporate social activities, providing opportunities to collaborate, interact with one another and adults from the community, and get or give positive, helpful feedback. Data from this study

aligned with literature in that adolescents need applications in their learning activities that provide positive social interactions with adults and peers, frequent transitions, and social-based activities in a media-rich environment (Dede, 2014; DiPetro et al., 2008).

Finding 6: Best Practices Regarding Creative Communicator, ISTE Standard 6

ISTE Standard 6 focuses on cultivating creative communication in students. Specifically, it addresses skill development for students to communicate clearly and express themselves creatively for a variety of purposes using the platforms, tools, styles, formats, and digital media appropriate to their goals. The most important best practices to develop creative communicators incorporated the use of productivity applications and a variety of digital tools for collaboration and information sharing.

Additionally, participants stated they utilized a variety of digital resources to enrich the learning environment and provided clear, accurate communication of information to others and among others. One tool for this to occur was the use of a learning management system (LMS) in the middle school classroom that allowed for multiple and varied applications for communication and myriad technology resources for student-centered inquiry. Participants facilitated ISTE Standard 6 through using technology applications and creating lessons and assessments that engage students through interactive technologies that advance learning and creativity. Participants rated the following best practices of high importance:

1. Structure and clear limits
2. Competence and achievement
3. Positive social interaction with adults and peers
4. Meaningful participation by families, schools, and communities

Participant responses to open-ended survey question provided insight as to the importance of structure and clear limits; they stated this was crucial to an effective lesson. Additionally, respondents explained how building competence and achievement supported middle school students and was essential to an effective technology learning activity. Expert middle school teachers designed lessons incorporating clear examples, rubrics, ongoing feedback, multiple drafts, and peer/adult feedback to support deeper learning in their development of becoming a creative communicator. The literature stressed the importance of what companies are looking for in their potential employees, such as employees are those who can demonstrate they are critical thinkers, effective collaborators, creative innovators, and articulate communicators (Friedman & Mandelbaum, 2011; P21, 2008; Petersen, 2010). The data and literature provided evidence of the need to develop creative communication skills in middle school students.

Finding 7: Best Practices Regarding Global Collaborator, ISTE Standard 7

ISTE Standard 7 challenges educators to design learning environments that empower students to use digital tools to broaden their perspectives and enrich their learning by collaborating with others and working effectively in teams locally and globally. Best practices that supported Standard 7 included designing 21st century skill development lessons and incorporating opportunities for students to work through problems addressing real-world issues that support ethics and social responsibility.

Participants rated the following best practices of high importance for global collaboration wherein students used digital tools to connect with learners from a variety of backgrounds and cultures, engaged in ways that broadened understanding and

learning, used collaborative technology to work with others including peers and experts in the field, contributed constructively to project teams, and explored local and global issues to work with others to investigate solutions. Two ways these were accomplished were:

1. Assign projects that require students to search for and evaluate information through electronic resources and other appropriate technologies exploring real-world issues and authentic problems
2. Use 21st century skill development applications that involve core content, critical thinking/problem-solving, communication skills, creativity, leadership, ethics/social responsibility, personal accountability, and evaluation

Data from surveys and interviews showed a continued theme of the use of technology infused project- or problem-based learning (PBL) to promote successful middle school technology integration. Additionally, the literature explained how PBL with 21st century skill development is vital in today's education (Friedman & Mandelbaum, 2011; Mahunik, 2014; P21, 2011; Welmond, 2002). Marzano (2015) described four key components as essential for learning: connections to real-world experts (adults/peers), participation in groups, frequent feedback, and active engagement. The data provided evidence of what was stated in the literature review and supported the best practice of developing global collaborators (ISTE, 2016).

Finding 8: Student Engagement is a Critical Component

A learning environment that provides a safe space to take risks in conjunction with engaging, purposeful skill development helps provide the structures necessary for

middle school students to thrive (Glick, 2014; Stevenson, 2002; Thornburg, 1983; Wiles et al., 2006). Additionally, Lenz and Kingston (2016) stated digital integration when done well provided engaging learning environments where students could apply knowledge and deepen their understanding. Participants confirmed the importance of providing an engaging learning environment for middle school students and how this above all else needs to be the goal of an effective learning activity. Engagement kept students learning at deeper levels. Engagement is one of the four key components to learning (Marzano, 2015). Middle school students are developmentally unique, needing specific learning environments to meet their needs (AMLE, 2010). Participatory learning environments keep students engaged to support deeper learning while developing 21st century skills (P21, 2008). Middle school students are best served when they have participatory learning environments that fully engage for them to be successful (AMLE, 2010).

Finding 9: Varied Barriers to Technology Integration Exist

A variety of barriers to technology integration still exist in the emerging Global Age. Barriers to successful technology integration in middle school were identified in the survey when respondents ranked 13 possible barriers. The top five barriers from the survey based on a reported high impact were:

1. Lack of technology resources
2. Inadequate funding to implement instructional technology
3. Large class size
4. Insufficient time for learning and implementing new technology
5. Insufficient internet connectivity (bandwidth)

These findings were supported by the literature review (Avidov-Ungar & Eshet-Alkalai, 2014). Unequal access to technology still exists as seen in the data and literature (LEAD, 2012; Purcell et al., 2013). Lack of access to technology raises questions about equity for students as well.

Unexpected Findings

Three unexpected findings arose from the research. The first unexpected finding was regarding teacher and student frequency of technology use, where teachers used technology in the classroom much more frequently than students. The second unexpected finding was that students as active participants in setting educational goals, managing learning, and assessing their own progress was scored the lowest by the expert teachers. Lastly, the literature review reported early adolescent developmental needs of physical activity and social interaction were significant, but the data did not definitively support this concept.

Conclusions

Based on the findings from this study and the review of literature, six conclusions were drawn.

Conclusion 1

Based on the findings and as supported by the literature, middle school teachers will not be successful integrating technology unless they design, customize, monitor, and assess the digital learning environment while providing equal access to technology. Personalized learning experiences need to incorporate a variety of digital tools providing inspirational opportunities while challenging students by pushing them through their zone of proximal development with tasks that address their style of learning. Doing so

could enhance curiosity through student-centered inquiry and incorporating active participation as they set their own educational learning goals and monitor their progress. Equal access with personalized learning is essential to develop an empowered learner in a technology integrated classroom (Fullan & Langworthy, 2013; Lenz & Kingston, 2016; New Pedagogies for Deeper Learning Global Partnership, 2014).

Conclusion 2

Based on the findings and as supported by the literature, middle school teachers must utilize clear, explicit instruction on the proper use of the Internet and technological applications to ensure students are responsible digital citizens. Students need to be provided equitable access to technology and be explicitly taught what it means to be a digital citizen and how to use technology appropriately (ISTE, 2016). To develop a responsible middle school digital citizen in a global world, teachers must use clear expectations, model behaviors, provide access for all, and engage in ongoing instruction and dialogue (Fryer, 2009; Fullan & Langworthy, 2013; Lopez, 2010).

Conclusion 3

Based on the findings and as supported by the literature, successful middle school technology integration will not occur unless teachers provide students opportunities to construct knowledge through authentic, relevant, and real-world PBL activities. Students develop deeper levels of learning when they feel a sense of purpose and engage in developing real-world solutions through a variety of multimedia resources such as research and inquiry applications, technology applications, hands-on activities, simulations, and video creation. As part of knowledge construction, students learn how to apply knowledge, although they need to also be guided with clear expectations on

exploration of information. Fullan (2013) noted that unless technology is effectively used to engage students and deepen learning in cognitively complex tasks, it is ineffective. Organizing technologies through PBL is an example of matching technologies with particular pedagogies, which Fullan (2013) described as a requirement for effective technology use.

Conclusion 4

Based on the findings and as supported by the literature, if middle school teachers do not create and deploy inquiry projects based on real-world problems to deepen middle school student learning, technology integration will not be successful and students will not develop as innovative designers. Technology integrated learning activities with the following characteristics will inspire innovative design; unique, student-selected, real-world, collaborative, interactive, hands-on, and game-like (Fullan, 2013; Marzano, 2015).

Conclusion 5

Based on the findings and as supported by the literature, middle school teachers must create technology integrated lessons that support computational thinking through seamless integration of content, technology, and resources. Students employ critical thinking strategies by using an LMS where students can access resources to solve problems, leverage technological methods, formulate problem definition, analyze data, utilize abstract models, and explore solutions with the use of rubrics, standards, and feedback, albeit peer and/or teacher (ISTE, 2016).

Conclusion 6

Based on the findings and as supported by the literature, students will not develop or deepen their learning if they are not engaged and provided equal opportunities and access to technology, resources, and curriculum. Effective technology integration must happen across the curriculum in ways that deepen and enhance the learning process (Fullan, 2013; Marzano, 2015). Additionally, barriers to providing access to technology exist due to lack of resources creating growing inequities regarding digital learning access between high- and low-income students and school districts (LEAD, 2012). Equitable access is crucial for students to be prepared for the digital age.

Implications for Action

The American public school system is the largest education system in the world, serving millions of students per year (CDE, 2016). It is a system with a local-level district board that matriculates students with the goal to be college- and career-ready when they graduate from high school. The critical work for the K-12 public education system is to prepare students to pursue further options in career-ready opportunities, advance their learning to develop more skills in occupational training, and/or prepare them to enter either public or private 4-year colleges One of the key areas of preparation for the global age is in the area of deep learning that utilizes technology. The following are implications for actions based on the findings and conclusions from this study.

Quality professional development for middle school teachers regarding the use of technology in the implementation of real-world, problem-based units for students. It is recommended the California Department of Education partner with ISTE, P21, and a taskforce of expert teachers to develop quality professional development to

instruct middle school teachers how to use technology in highly engaging lessons with real-world applications.

Ensure the sharing of technology integration best practices by expert middle school teachers at middle school-focused conferences. It is recommended AMLE, the California League of Middle Schools (CLMS), and the Association of California Administrators Middle Schools Council make technology integration a vision priority for all conferences to ensure the quality sharing and collaboration on the topic of middle school technology integration best practices. Expert middle school teachers provided responses regarding their successful best practices and sharing these in a wide venue would allow more teachers to create technology integrated learning experiences.

Technology companies should collaborate with local universities to create regional laboratory schools to act as training grounds for interns and teachers. It is recommended technology companies (e.g., Apple, Cisco, Microsoft, Adobe) partner with public and private universities to provide teacher training necessary to prepare students for the 21st century. These partners should come together to create a laboratory school, curriculum, pedagogy, and best practices data banks of lessons and units. The laboratory schools would serve as places for testing new ideas and showcasing best practices where experts can model and teach highly engaging, technology infused, inquiry projects on real-world and relevant issues. This would work like a medical center that trains and teaches medical staff of all levels.

Provide regular, ongoing collaboration time for middle school teachers. It is recommended all middle schools have mandatory, dedicated weekly collaboration time and part of that time be dedicated to focus on best practices related to the ISTE

standards. To realize this potential, districts must have early successful adoption of appropriate pedagogies with technology and be willing to evolve as the teacher role continually evolves (Dintersmith, 20187; Martin, 2018). Sites need to support educators through effective learning models that support (1) student-centered inquiry, (2) 21st century skills, (3) relevant real-world issues, (4) innovative designs, (5) clear and high expectations, (6) developmentally appropriate activities, and (7) knowledge construction through student choice (Christensen, 2011, 2013; ISTE, 2016; Marzano, 2014, 2015; McDowell, 2017).

Teacher credential programs must include more explicit units in the use of technology to deepen learning and engagement. It is recommended California mandate, through policy in partnership with the California Commission on Teacher Credentialing, that teacher credentialing entities (e.g., public and private colleges, county offices) include training to support new teacher candidates with the knowledge they need to successfully integrate technology in conjunction with student-centered, inquiry-based learning. The actual course curriculum for the teacher credential program would be developed by expert teachers and be informed by research.

Equitable access to technology resources is needed across all districts, sites, grades, and students. It is recommended California mandate specific funding and a technology plan that puts adequate technology resources in the hands of every school and every student. The state must ensure proper support and guidance to teachers, and therefore to students, in how to use appropriate technologies for deeper learning. Once funded, districts should be tasked to develop a local technology plan that incorporates the following supports:

- Develop site leaders to support ongoing teacher and student learning
- Develop technology leaders so each site has a technology person effective in middle school teaching practices to support teachers and students
- Utilize the ISTE Standards to guide ongoing change
- Implement and support time within work day for professional learning
- Utilize professional learning models and provide time within the day to look at practices and student learning on a rotating basis
- Develop teams to support ongoing growth
- Create a consortium of teachers across districts to construct content-specific, digital-based units with teachers paid to design and develop these resources
- Pay for identified teachers to become a cadre of designers to develop exemplary technology integrated lessons across all content areas

Margaret Honey at the Education Development Center testified before the U.S. Senate that one could find ample empirical evidence that technology had a positive impact with the right conditions in place (Honey, Culp, & Carrigg, 2000).

Recommendations for Further Research

Based on the findings of this study, the following are recommendations for further research:

- Conduct a correlational study to look at frequency and type of technology use by teachers and students in the classroom, and to identify any relationship that exists between the variables and how to increase the frequency of student technology use in the classroom

- Conduct a phenomenological study from the perspective of middle school students regarding their use of technology daily both inside and outside the school day
- Conduct a multi-case mixed methods explanatory study describing best practices for technology integration across three identified levels (K-5, 6-8, 9-12) providing a more comprehensive perspective across the K-12 system
- Conduct a case study of three high-performing California middle schools to identify and explore technology integration practices teachers perceive as key to their high performance
- Conduct a mixed methods study of middle school principals who deployed 1:1 initiatives to identify and describe the best practices of leading a 1:1 technology initiative

Concluding Remarks and Reflections

The researcher took on the challenge of this topic six years ago when a local middle school in the district pioneered technology infused, problem-based, student-centered inquiry learning. At that time, the researcher worked with the team piloting the use of 1:1 technology in conjunction with an LMS delivering content through the lens of 21st century skills development (e.g., critical thinking, communication, creativity, character, global citizenship, agency). It was a new horizon to empower deeper levels of student learning while keeping students engaged with access to technology and the myriad resources associated with technology. It was exciting to be involved in meaningful change that would help students for their future. After a few years of building the team's capacity and walking through the learning needed, the researcher

wondered if this was the best way to support deeper student learning to lead to future success. This study arose out of that questioning. As the dissertation journey began, there was little information published on this topic, let alone any known models at the middle school level the researcher could find. After looking through the history of technology and its rapid evolution the past 20 years, it helped guide the next steps in this process.

This study evolved from a personal point of interest and showed the depth of change still needed for effective technology integration. In completing this study, the researcher was surprised as to how limited resources still are at school sites. Teachers still struggle with functioning technology and internet access. It was quite disappointing to discover the lack of support sites had and how teachers trying to champion effective technology use in their class had many external barriers to overcome. The tenacity and perseverance exemplified by the teachers still shines through despite the barriers.

Change is essential and needed from the district, community, teacher training educational institutions, and private and public companies to support teachers in successful technology integration. Ultimately, successful integration of technology is a long-term game. Undergoing these changes takes multiple processes over many years to achieve mastery to support student learning. Transformational change processes need to be well-planned and supported throughout internal and external structures.

Through the process of this study, the researcher realized technology infused PBL aligned with the standards supports effective and successful student learning. Students love to learn, and it is crucial to provide them with opportunities to keep that love for learning alive. This can be done through fun, interactive, challenging, real-life

problems where students are empowered to develop meaningful solutions. Student-centered, inquiry- and standards-based learning is attainable regardless of the model. ISTE Standards, SAMR, LoTi, New Tech Learning Outcomes, and TPACK all provide resources needed to evolve and grow practice for the betterment of students.

The dissertation process has been priceless in growing new layers of understanding. The researcher developed a greater respect for and understanding of the value of research and data, and grew in terms of clarity regarding how helpful information is to guide decisions and support implications. This resulted in becoming more courageous about ambiguity, tackling the ambiguity with a lens to frame it for understanding, and developing decisions based on data. The researcher looks forward to pursuing and applying the skills learned in this study to support schools and communities toward transformation and change for students and their future.

REFERENCES

21st Century Workforce Commission (2000). *A nation of opportunity: Building America's 21st century workforce*. Washington, DC: U.S. Department of Labor.

Adcock, P. K. (2008). *Evolution of teaching and learning through technology. Teacher education faculty publications* (Paper 56). Retrieved from http://digitalcommons.unomaha.edu/tedfacpub/56.

Adedokum, A. A., (2016). *Nigeria secondary school teachers' demographics, perception, and level of technology integration: a correlational study.* Available from ProQuest Dissertations & Theses. (UMI No. 18677459)

Ahlberg, M., Turja, L., & Robinson, J. (2003). Educational research and development to promote sustainable development in the City of Helsinki: Helping the Accessible Helsinki Programme 2001-2011 to achieve its goals. *International Journal of Environment and Sustainable Development, 2*(2), 197-209.

Alber, R. (2017). Deeper learning: A collaborative classroom is key [Blog]. Retrieved from https://www.edutopia.org/blog/deeper-learning-collaboration-key-rebecca-alber

Alexander, W. M., & McEwin, C. K. (1989). *Schools in the middle: Progress 1968-1988*. Retrieved from https://www.amle.org/portals/0/pdf/articles/Status_Programs_Practices_AMLE.pdf

Alexander, W. (1963). This we believe: Keys to educating young adolescents (Kindle edition). Westerville, OH: National Middle School Association.

Allison, B. N., & Rehm, M. L. (2007). Effective teaching strategies for middle school learners in multicultural, multilingual classrooms. *Middle School Journal 39*(2), 12-16.

Anderson, T. (2012). Networks, Web 2.0, and the connected learner. *Trends and Issues in Instructional Design and Technology*, 299-308.

Anderson, R. E., & Dexter, S. (2003). *Newsome Park Elementary: Making learning meaningful through project-based learning using wireless laptops in a K-5 math, science and technology magnet school.* Retrieved from http://edtechcases.info/schools/newsome/newsome.htm

Anfara, V. A., Jr., Andrews, G., & Mertens, S. B. (Eds.) (2005). *The encyclopedia of middle grades education*. Greenwich, CT: Information Age Publishing.

Association for Middle Level Education. (2010). *This we believe: Keys to educating young adolescents.* Westerville, OH: Author.

Avidov-Ungar, O., & Eshet-Alkalai, Y. (2014). TPACK revisited: A systemic perspective on measures for predicting effective integration of innovative technologies in school systems. *Journal of Cognitive Education and Psychology, 13*(1). Retrieved form http://www.achva.ac.il/sites/default/files /cognitive_ education.pdf

Baker, S. (2014). School-wide twitter chats [Blog]. Retrieved from http://www.edutopia .org/blog/ school-wide-twitter-chats-stephen-baker?utm_source=twitter&utm _medium=post&utm_campaign=blog-school-wide-twitter-chats-link

Barbour, M., Brown, R., Waters, L. H., Hoey, R., Hunt, J. L., Kennedy, K., & Trimm, T. (2011). *Online and Blended Learning: A Survey of Policy and Practice from K-*

12 Schools around the World. Retrieved from http://www.inacol.org/wp-content/uploads/2012/11/iNACOL_IntnlReport2011.pdf

Bauer, J., & Kenton, J. (2005). Toward technology integration in the schools: Why it isn't happening. *Journal of Technology and Teacher Education, 13*(4), 519-546.

Bellanca, J., & Brandt, R. (2010). *21st century skills: Rethinking how students learn*. Bloomington, IN: Solution Tree.

Becker, H. J. (2001, April). *How are teachers using computers in instruction*? Annual meeting of the American Educational Research Association, Seattle, WA.

Bergmann, J., & Sams, A. (2012). Flip your classroom: Reach every student in every class every day. *International Society for Technology in Education.*

Boland, D. L. (2008). *An analysis of factors affecting teachers' technology integration as perceived by high school teachers.* (Doctoral dissertation). Available from ProQuest Dissertations & Theses database. (UMI No. 3340148).

Boss, S. (2008). Overcoming technology barriers: Ho to innovate without extra money or support. *Edutopia.* Retrieved from http://www.edutopia.org/technology-how-to-implement-classroom

Boss, S. (2011). *Project based learning: What do the experts say.* Retrieved from https://www.edutopia.org/project-based-learning-experts#SylviaChard

Boss, S. (2013). *PBL for 21st century success.* Novato, CA: Buck Institute for Education.

Brighton, P., & Foy, D. (2007). *News values*. Thousand Oaks, CA: SAGE Publications.

Brookfield, S. (1995). *The getting of wisdom: what critically reflective teaching is and why it's important.* Critically reflective teacher. San Francisco, CA: Jossey-Bass.

Brooks-Gunn, J., Petersen, A. C., & Eichorn, D. (1985). The study of maturational timing effects in adolescence. *Journal of youth and adolescence, 14*(3), 149-161.

Brown, D. F. & Knowles, T. (2014). *What every middle school teacher should know* (3rd. ed.). Westerville, OH: National Middle School Association.

Brush, T. (1997). The effects on student achievement and attitudes when using integrated learning systems with cooperative pairs. *Educational Technology Research and Development, 45*(1), 51-64.

Buckingham, D. (2007). *Beyond technology: Children's learning in the age of digital culture.* Malden, MA: Polity Press.

Buckner, E., & Kim, P. (2013). Integrating technology and pedagogy for inquiry-based learning: The Stanford mobile inquiry-based learning environment (SMILE). *Prospects Quarterly Review of Comparative Education*. doi: 10.1007/s11125013-9269-7.

Burbules, N. C., & Torres, C.A. (Eds.). (2000). *Globalization and education: Critical Perspectives.* New York, NY: Routledge.

Bureau of Labor Statistics. (2015). *Occupational outlook handbook, 2016-17 edition, middle school teachers*. Washington, DC: Author. Retrieved from http://www.bls.gov/ooh/education-training-and-library/middle-school-teachers.htm

Caissy, G. A. (2002). *Early adolescents: Understanding the 10 to 15 year old's* (2nd ed.). Boston, MA: Da Capo Press.

California Department of Education. (2016). QuickQuest: Demographic data files. Retrieved from https://dq.cde.ca.gov/dataquest/content.asp

Cañas, A. J., Reiska, P., Åhlberg, M., & Novak, J. D. (2003). Concept maps and short-answer tests: probing pupils 'learning and cognitive structure. *The Sun.*

Carrier, K. A. (2005). Key issues for teaching English language learners in academic *classrooms. Middle School Journal.* Retrieved from http://files.eric.ed.gov /fulltext/EJ752850.pdf

Casey, B. J., Giedd, J. N., & Thomas, K. M. (2000). Structural and functional brain development and its relation to cognitive development. *Biological Psychology, 54*, 241-257.

Caskey M., & Anfara, V. (2014). *Developmental characteristics of young adolescents: Research summary.* Retrieved from https://www.amle.org/BrowsebyTopic/WhatsNew/WNDet/TabId/270/ArtMID/888/ArticleID/455/Developmental-Characteristics-of-Young-Adolescents.aspx

Caskey, M. M., & Ruben, B. (2007). Under construction: The young adolescent brain. In S. B. Mertens, V. A. Anfara, Jr., & M. M. Caskey (Eds.), *The young adolescent and the middle school* (pp. 47-72). Charlotte, NC: Information Age.

Cator, K., Schneider, C., & Vander Ark, T. (2014) *Teachers for deeper learning: Competency-based teacher preparation and development*. Retrieved from http://b.3cdn.net/dpromise/43ccff9cfdd2cf0d57_tvm6v3qzx.pdf

Cennamo, K. S., Ross, J. D., & Ertmer, P. A. (2014). *Technology integration for meaningful classroom use: a standards-based approach* (2nd ed.). Belmont, CA: Wadsworth, Cengage Learning.

Chard, S. C. (1998). *The project approach*. New York, NY: Scholastic. Retrieved from http://files.eric.ed.gov/fulltext/ED340518.pdf

Christensen, C. M. (2011). *Disrupting class: How disruptive innovation will change the way the world learns.* Boston, MA: McGraw-Hill Books.

Christensen, C. M., Horn M. B., & Staker, H. (2013). *Is K-12 blended learning disruptive? An introduction to the theory of hybrids.* Retrieved from http://3jrru23si058 xyg03 oiyzu9p.wpengine.netdna-cdn.com/wp-content/uploads/2014/06/Is-K-12-blended-learning-disruptive.pdf

Chung, J. H. (2007). *Integrating technology into the classroom.* Retrieved from www.usma.edue/cfe/Literature/Chung_07.pdf

Comcast. (n.d.). *Internet essentials from Comcast: Q&A.* Retrieved from http://www.egovlink.com/public_documents300/northhuntingdon/published_documents/Comcast%20Internet%20Essentials/Questions%20and%20Answers.pdf

Creswell, J. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Boston, MA: Pearson.

Creswell, J. W. (2014). *Research design: qualitative, quantitative and mixed methods approaches* (4th ed.). Thousand Oaks, CA: Sage Publications.

Cuban, L. (1993, Winter). Computer meet classroom: Classroom wins. *Teacher College Record, 95*(2), 185210.

Cuban, L. (2004). *The blackboard and the bottom line.* Cambridge, MA: Harvard University Press.

Cuban, L., Kirkpatrick, H., & Peck, C. (2001). High access and low use of technologies in high school classrooms: Explaining an apparent paradox. *American Educational Research Journal, 38*(4), 813834.

Dahl, R. E. (2004). Adolescent brain development: A period of vulnerabilities and opportunities. In R. E. Dahl & L. P. Spear (Eds.), *Annals of the New York Academy of Sciences: Vol. 1021. Adolescent brain development: Period of vulnerabilities and opportunities* (pp. 1-22). New York, NY: The New York Academy of Sciences.

Darling-Hammond, L. (2010). *The flat world and education; how America's commitment to equity will determine our future*. New York, NY: Teachers College Press.

Darrow, R. (2012). *New blended learning definition*. Retrieved from http://robdarrow.wordpress.com/2012/05/09/new-blended-learning-definition/

Dawson, K. (2012). Using action research projects to examine teacher technology integration practices. *Journal of Digital Learning in Teacher Education, 28*(3),

Dede, C. (2014). *The role of digital technologies in deeper learning.* Boston, MA: Jobs for the Future. Retrieved from http://www.studentsatthecenter.org/sites/scl.dl-dev.com/files/The-Role-of-Digital-Technologies-in-Deeper-Learning-120114.pdf

Dessoff, A. (2012). Robert J. Marzano: Robert Marzano says it starts with students and teachers in classrooms. *District Administration*, *3*, 78.

Detwiller, H. (2007). *A model for visioning, planning, and designing a facility for twenty-first century learners* (Doctoral dissertation). Available from ProQuest Dissertations & Theses database. (UMI No. 3273906)

Digital History. (2016). *Timeline for technology*. Retrieved from http://www.digitalhistory.uh.edu/timelines/timelinetopics.cfm?tltopicid=12

DiPetro, M., Ferdig, R. E., Black, E. W., & Preston, M. (2008). Best practices in teaching k-12 online: lessons learned from Michigan virtual school teachers. *Journal of Interactive Online Learning, 7*(1). Retrieved from www.ncolr.org/jiol

Donnelly, M. (2015). *Adolescent development. Research starters: Education* (Online Edition). Retrieved from http://libproxy.chapman.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,uid&db=ers&AN=89164056&site=eds-live

Drolet, M., & Arcand, I. (2013). Positive development, sense of belonging, and support of peers among early adolescents: Perspectives of different actors. *International Education Studies, 6*(4) 29-38. Retrieved from http://www.eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=EJ1067610

Earle, R. S. (2002). The integration of instructional technology into public education. *Promises and Challenges,* 42(1), 5-13. Retrieved from http://isites.harvard.edu/fs/docs/icb.topic87187.files/Earle02.pdf

EdSource. (2010). *Gaining ground in the middle grades: Why some schools do better.* Retrieved from http://files.eric.ed.gov/fulltext/ED508674.pdf

EdTech Review. (2016). *Reasons why teachers & institutions are not able to bring technology into real practice.* Retrieved from http://www.pbs.org/wgbh/americanexperience/about/search/search_results.html?q=technology&q_submit.x=0&q_submit.y=0

Education Technology Magazine. (2002). *The integration of instructional technology into public education: Promises and challenges, 42*(1), 5-13. Retrieved from http://isites.harvard.edu/fs/docs/icb.topic87187.files/Earle02.pdf

Edutopia. (2007). *What is successful technology integration?* Retrieved from http://www.edutopia.org/technology-integration-guide-description

Edutopia. (2014). *Technology integration: What experts say.* Retrieved from http://www.edutopia.org/technology-integration-experts

Eliot, C. W. (1916). *Changes needed in American secondary education* (No. 2). New York, NY: General Education Board.

Ertmer, P. A. (1999). Addressing first and second order barriers to change: Strategies for technology integration. *Educational Technology Research and Development, 4*(4), 47 61.

Ertmer, P. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development, 53*(4), 25-39.

Ferdig, R. E., & Kennedy, K. (2014) *Handbook of research on k-12 online and blended learning.* Retrieved from http://press.etc.cmu.edu/files/Handbook-Blended-Learning_Ferdig-Kennedy-etal_web.pdf

Ferending, K. A. (2003). *Questioning technology: Electronic technologies and educational reform.* New York, NY: Peter Lang Publishing, Inc.

Figg, C., & Jaipal, K. (2012). TPACK-in-Practice: Developing 21st century teacher knowledge. In P. Resta (Ed.), *Proceedings of society for informational technology & teacher educational international conference 2012* (pp. 4683-4689). Chesapeake, VA: AACE.

Fisher, D., & Frey, N. (2007). *Checking for understanding: Formative assessment techniques for your classroom*. Alexandria, VA: ASCD.

Finley, T. (2014). *Dipsticks: Efficient ways to check for understanding.* Retrieved from https://www.edutopia.org/blog/dipsticks-to-check-for-understanding-todd-finley

Fitzgerald, B. (2005). An existential view of adolescent development. *Adolescence, 40*, 793-799.

Fletcher, G., Schaffhauser, D., & Levin, D. (2012). *Reimagining the K-12 Textbook in a digital age.* Washington, DC: State Educational Technology Directors Association.

Friedman, T. L., & Mandelbaum, M. (2011). *That used to be us: How America fell behind in the world it invented and how we can come back*. New York, NY: D & M Publishers, Inc.

Friedman, T. L. (2005). *The world is flat*. New York, NY: Farrar, Straus and Giroux.

Fryer, W. (2009). *Why should middle school students blog? Moving at the speed of creativity.* Retrieved from http://www.speedofcreativity.org/2009/05/13/why-should-middle-school-students-blog/

Fullan, M. (2013). *Stratosphere: Integrating technology, pedagogy, and change knowledge.* Toronto, Canada: Pearson Canada, Inc.

Fullan, M., & Donnelly, K. (2013). *Alive in the swamp: Assessing digital innovations in education*. London, England: Nesta. Available online: www.nesta.org.uk/library/documents/Alive_in_the_Swamp.pdf

Fullan, M., & Langworthy, M. (2013). *Towards a new end: New pedagogies for deep learning.* Seattle, WA: Collaborative Impact.

Fullan, M., & Langworthy, M. (2014). A *Rich Seam: How pedagogies find deep learning.* Retrieved from http://www.michaelfullan.ca/wp-content/uploads/2014/01/3897.Rich_Seam_web.pdf

Gardner, H. (1999). *Intelligence reframed: Multiple intelligences for the 21st century*. Hatchette, United Kingdom: Basic Books.

Garthwait, A., & Weller, H. G. (2005). A year in the life: Two seventh grade teachers implement one-to-one computing. *Journal of Research on Technology in Education, 37*(4), 361-377.

Gay, L. R., Mills, G. & Airasian, P. W. (2009). *Educational research: Competencies for analysis and application* (9th ed.) Uppers Saddle River, NJ: Pearson.

Ghemawat, P. (2007). Why the world isn't flat. Foreign Policy March-April.

Glick, M. (2014). *Three brain research principles for the 21st century classroom*. Retrieved from http://www.Partnership for 21st Century Skills.org/news-events/Partnership for 21st Century Skillsblog/1320-glick-brain-research-three-principles-for-the-21st-century-classroom

Gloer, S. R. (2007). *The contribution of John Lounsbury to the development of the middle school movement in American education: an oral history* (Doctoral dissertation). Retrieved from https://baylor-ir.tdl.org/baylorir /bitstream/handle /2104/5054/Sheila_Gloer_edd.pdf?sequence=2

Godfrey, C. M. (2013). *Barriers to the integration of educational technology in the middle school classroom: A study of teacher learning practices*. Ottawa, Canada. Library and Archives.

Goleman, D., & Senge, P. (2014). The triple focus: A new approach to education. *More Than Sound. Reflections, 14*(1).

Gottlieb, A. S. (2006). *Constructivist middle level teachers: an explorative analysis of their backgrounds, passions and tolerance for ambiguity* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 3210267)

Gray, K., & Steer, D. N. (2012). Personal response systems and learning: it is the pedagogy that matters, not the technology. *Journal of College Science Teaching, 41*(5), 80-88.

Gray, L., Thomas, N., & Lewis, L. (2010). *Teachers' Use of Educational Technology in US Public Schools: 2009. First Look* (NCES 2010-040). Washington, DC: National Center for Education Statistics.

Hargreaves, A., & Fullan, M. (2012). *Professional capital: Transforming teaching in every school*. New York, NY: Teachers College Press.

Harris, J., Mishra, P., & Koehler, M. (2009). Teachers' technological pedagogical content knowledge and learning activity types: Curriculum-based technology integration reframed. *Journal of Research on Technology in Education*, *41*(4), 393-416.

Hattie, J. (2008). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. New York, NY: Routledge.

Hattie, J. (2012). *Visible learning for teachers: Maximizing impact on learning*. New York, NY: Routledge.

Hattie, J., & Yates, G. C. (2013). *Visible learning and the science of how we learn*. New York, NY: Routledge.

Hayes, W. (2004). *Are we still a nation at risk two decades later?* Lanham, Md. Scarecrow Education.

Hayes, D. N. (2007). ICT and learning: Lessons from Australian classrooms. *Computers & Education, 49*(2), 385-395.

Heick, T. (2014. Fixing detached schools via tech [Blog]. Retrieved from http://www.edutopia.org/blog/fixing-detached-schools-via-tech-terry-heick

Hertz, M. B. (2010). Integrating technology with limited resources [Blog]. Retrieved from http://www.edutopia.org/blog/free-tech-integration-resources

Hertz, M. B. (2011). What does "technology integration" mean? *Edutopia.* Retrieved from http://www.edutopia.org/blog/meaning-tech-integration-elementary-mary-beth-hertz

Hew, K. F., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research. *Educational Technology Research and Development*, *55*(3), 223-252.

Hirumi, A. (2002*).* Student-centered, technology-rich learning environments (SCENTRLE): Operationalizing constructivist approaches to teaching and learning. *Journal of Technology and Teacher Education, 10*(4), 497-537.

Holland, B. (2014). The backchannel: Giving every student a voice in the blended mobile classroom [Blog]. Retrieved from http://www.edutopia.org/blog/ backchannel-student-voice-blended-classroom-beth-holland?utm_source= facebook &utm_ medium=post&utm_campaign=blog-backchannel-student-voice-blended-classroom-jar-of-jargon-image

Honey, M., Culp, K. & Carrigg, F. (2000). Perspectives on technology and education research: lessons from the past and present. *Journal of Educational Computing Research,* 23(1), 5-14. DOI 10.2190/7VV9-4G08-U0BX-REEJ

Horn, M., & Staker, H. (2011). *The rise of K-12 blended learning.* Retrieved from http://www.innosightinstitute.org/innosight/wp-content/uploads/2011/01/The-Rise-of-K-12-Blended-Learning.pdf

Horn, M., & Staker, H. (2014, December 10). *Blended learning is about more than technology. Education Week*. Retrieved from http://www.edweek.org/ew/articles/2014/12/10/blended-learning-is-about-more-than-technology.html

International Society for Technology in Education. (2016). *ISTE Standards for students.* Retrieved from http://www.iste.org/standards/standards/standards-for-students

International Society for Technology in Education. (2017). *ISTE Standards for teachers.* Retrieved from http://www.iste.org/standards/standards/standards-for-teachers

Ito, M. (2013). *Hanging out, messing around, and geeking out: Kids living and learning with new media.* Cambridge, MA. The MIT Press.

Ito, M., Horst, H., Bittani, M., Boyd, D., Herr-Stephenson, B., Lange, P.G., Pascoe, C.J., & Robinson, L. (2008). *Living and learning with new media: Summary of findings from the digital youth project.* Retrieved from http://www.mac found.org.

Januszewski, A., & Molenda, M. (2008). *Definition: Definition and terminology committee of the association for educational communications and technology* (2nd ed.). New York, NY: Lawrence Erlbaum Associates.

James, M. L. (2009). *Middle school teachers' understanding of technology integration.* (Doctoral Dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 3387974)

Javeri, M. & Persichitte, K. (2007). Measuring technology integration practices of higher education faculty with an innovation component. *International Journal of Technology in Teaching and Learning 3*(1), 28-50.

Jones, N. (2006). From the sage on the stage to the guide on the side: The challenge for educators today. *ABAC Journal, 26*(1).

Joubert, M., & Sutherland, R. (2009). A perspective on the literature: CPD for teachers of mathematics. United Kingdom: National Centre for Excellence in the Teaching of Mathematics.

Juliani, C. M. C. M., Corrente, J. E., & Dell'Acqua, M. C. Q. (2011). Comparing the teaching-learning process with and without the use of computerized technological resources. *Computers Informatics Nursing*, *29* (6 Topical Collection), TC89-TC97.

Kellough, R. D., & Kellough, N. G. (2008). *Teaching young adolescents: Methods and resources for middle grades teaching* (5th ed.). Upper Saddle River, NJ: Pearson.

Killen, R. (2007). *Teaching strategies for outcomes-based education* (2nd ed.). Cape Town, South Africa: Juta & Co.

Kim, C., Kim, M. K., Lee, C., Spector, J. M., & DeMeester, K. (2013). Teacher beliefs and technology integration*. Teaching and Teacher Education, 29*, 76-85. Retrieved from http://ac.els-cdn.com/S0742051X1200131X/1-s2.0-

S0742051X1200131X-main.pdf?_tid=5080ddb6-7312-11e6-ad22-00000aacb361&acdnat=1473043497_12bd926bcf837a926639439d5b11ee6b

Knowles, T., & Brown, D. F. (2000). *What every middle school teacher should know.* Portsmouth, NH: Heinemann, National Middle School Association.

Kohler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education 9*(1).

Kopcha, T. J. (2012). Teachers' perception of the barriers to technology integration and practices with technology under situated professional development. *Computers & Education 59*, 1109-1121. Retrieved from http://marianrosenberg.wiki.westga.edu/file/view/KopchaTTeachersPerceptions.pdf

Krathwohl, (2009). *Methods of educational and social science research.* Long Grove, IL: Waveland Press, Inc.

Lawless, K. A., & Pellegrino, J. W. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. *Review of Educational Research, 77*(4), 575-614.

Leading Education by Advancing Digital Commission. (2012). Retrieved from http://www.leadcommission.org/about-lead

Lee, V. E., & Smith, J. B. (1993). Effects of school restructuring on the achievement and engagement of middle-grade students. *Sociology of Education*, 164-187.

Lenhart, A., Purcell, K., Smith, A., Zickuhr, K., (2010). Social Media & mobile internet use among teens and young adults. Retrieved from ERIC database. (ED525056)

Lenz, B., & Kingston, S. (2016). *Blending technology into project based learning*. Retrieved from http://www.p21.org/news-events/p21blog/1832-blending-technology-into-project-based-learning

López, O. S. (2010). The digital learning classroom: Improving English language learners' academic success in mathematics and reading using interactive whiteboard technology. *Computers & Education*, *54*(4), 901-915.

Lounsbury, J. H. (1960). *How the junior high school came to be.* Retrieved April 2016 from http://www.ascd.org/ASCD/pdf/journals/ed_lead/el_196012_lounsbury.pdf

Luckin, R., Bligh, B., Manches, A., Ainsworth, S., Crook, C., & Noss, R. (2012). Decoding learning: The proof, promise and potential of digital education. Retrieved from https://www.nesta.org.uk/sites/default/files/decoding_ learning_report.pdf

Machado, L. J., & Chung, C. J. (2015). Integrating technology: The principals' role and effect. *International Education Studies*, *8*(5), 43. Retrieved from file:///C:/Users/User/Downloads/42873-165716-1-PB%20(1).pdf

Magana, S. & Marzano, R.J. (2014). *Enhancing the art & science of teaching with technology.* Bloomington, IN; Marzano Research.

Mahunik, P. (2014). *Technology and education – how are public schools preparing students?* New Tech Network School Innovations Podcast. Retrieved from http://www.newtechnetwork.org/social/podcasts/technology-and-education-how-are-public-schools-preparing-students

Mansilla, V. B., & Gardner, H. (2009). Disciplining the mind. *Challenging the Whole Child: Reflections on Best Practices in Learning, Teaching, and Leadership*, 97-107.

Marzano, R. J. (2015). *Classroom techniques to help students generate and test hypotheses across disciplines.* West Palm Beach, Florida: Learning Sciences International. Retrieved from http://www.learningsciences. com/files/sample chapters/Marzano_Engaging_SampleChapter.pdf

Marzano, R. J., Pickering, D., & Pollock, J. E. (2001). *Classroom instruction that works: Research-based strategies for increasing student achievement*. Alexandria, VA: ASCD.

Mayor, A. (2015). *Comparative study of the practitioner's role to incorporate technology within an inquiry-based learning environment* (Doctoral dissertation). Available from ProQuest Dissertations & Theses. UMI No. 16913273)

McDowell, M. (2017). *Rigorous PBL design: three shifts for developing confident and competent learners.* Thousand Oaks, CA. Corwin.

McMillan, J. H., & Schumacher, S. (2010). *Research in education: Evidence-based inquiry* (7th ed.). Upper Saddle River, NJ: Pearson Education.

Mertens, S. B., Anfara, V. A., Jr., & Caskey, M. M. (Eds.). (2007). *The young adolescent and the middle school*. Charlotte, NC: Information Age.

Merrill, M. D. (2007). First principles of instruction: a synthesis. *Trends and issues in instructional design and technology, 2,* 62-71.

Meyer, P. (2011). The middle school mess. *Education Next, 11(1).* Retrieved from http://educationnext.org/the-middle-school-mess/

Mishra, P., & Koehler, M. J. (2008, March). *Introducing technological pedagogical content knowledge.* Proceedings from the Annual Meeting of the American Educational Research Association, New York, NY.

Mishra, P., Koehler, M. J., & Kereluik, K. (2009). Looking back to the future of educational technology. *TechTrends, 53*(5), 49.

Modgil, S., Modgil, C., & Brown, G. (Eds.). (2013). *Jean Piaget*. New York, NY: Routledge.

Moeller, B. & Reitzes, T. (2011) *Integrating technology with student centered learning*. Quincy, MA: Nellie Mae Education Foundation.

Moersch, C. (1995). Levels of technology implementation (LoTi): A framework for measuring classroom technology use. *Learning and leading with technology*, *23*, 40-40.

Molenda, M. (2008*). Processes*. In Januszewski, A. & Molenda, M. (Eds.), *Educational technology: A definition with commentary* (pp. 195-211). New York: Lawrence Erlbaum Associates.

Morphew, V. N. (2012). *A Constructivist Approach to the National Educational Technology Standards for Teachers*. Eugene, Oregon: International Society for Technology in Education.

Morrison, G. R., & Lowther, D. L. (2010). *Integrating computer technology into the classroom: Skills for the 21st century* (4th ed.). Boston, MA: Pearson Education, Inc.

Nagel, M. C. (2010). The middle years learner's brain. In D. Pendergast & N. Bahr (Eds.) *Teaching middle years: Rethinking curriculum, pedagogy, and assessment* (pp. 86-100). Crows Next, Australia: Allen & Unwin.

National Center for Education Statistics. (2016). State of education data profiles. Retrieved from http://nces.ed.gov/programs/stateprofiles/sresult.asp?mode=short&s1=06

National Commission on Excellence in Education. (1983). *A nation at risk: The imperative for educational reform*. Washington, DC: Government Printing Office.

National Educational Technology Standards for Teachers (2002). *Using Model Strategies for Integrating Technology into Teaching.* Preparing Teachers to Use Technology, ISTE (International Society for Technology in Education), 1.800.336.5191 (U.S. & Canada) or 1.541.302.3777 (Int'l), iste@iste.org, www.iste.org. Retrieved from http://www.iste.org/docs/excerpts/nettb2-excerpt.pdf

National Middle School Association. (2003). *This we believe: Successful schools for young adolescents: A position paper of the National Middle School Association*. Westerville, OH: Author.

National Middle School Association. (2010). *This we believe: Keys to educating young adolescents*. pp. 1-10, Westerville, OH: Author.

Nemko, B. (2014, January). Introduction speech. *Google in education summit.* Summit conducted at New Technology High School, Napa, CA.

Norris, C., Smolka, J., & Soloway, E. (2000). *Convergent analysis: A method for extracting the value from research studies on technology in education.* Retrieved from ERIC database. (ED452819)

Pacansky-Brock, M. (2013). *Best practices for teaching with emerging technologies.* New York, NY: Taylor & Francis.

Pardini, P. (2002). Revival of the K-8 School. *School Administrator*, *59*(3), 6-12.

Park, S. H., & Ertmer, P. A. (2007). Impact of problem-based learning (PBL) on teachers' beliefs regarding technology use. *Journal of Research on Technology in Education, 40*(2), 247-267.

Partnership for 21st Century Skills. (2008). *21st century skills, education and competitiveness.* Retrieved from http://www.Partnership for 21st Century Skills.org/documents/21st_century skills_education_and_ competitiveness_guide.pdf

Partnership for 21st Century Skills. (2011). *P21 common core toolkit: A guide to aligning the common core state standards with the framework for 21st century skills.* Washington, DC: Author.

Patten, M. L. (2012). *Understanding research methods: An overview of the essentials* (8th ed.). Glendale, CA: Pyrczak Publishing.

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.

Pearlman, B. (2006). Twenty-first century learning in schools: A case study of New Technology High School in Napa, California [Special Issue]. *New Directions for Youth Development*, *2006* (110), 101-112.

Peterson, P. E. (2010). *Saving schools: From Horace Mann to virtual learning.* Cambridge, MA. Harvard University Press.

Petty, D. (2012). *Exploring best practices in technology integration in teaching middle school students* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No.354566)

Piaget, J. (1952). *The origins of intelligence in children*. New York, NY: International University Press.

Piaget, J. (1960). *The child's conception of the world*. Atlantic Highlands, NJ: Humanities Press.

Pitler, H., & Barley, Z. (2004). *McREL Technology Initiative: The Development of a Technology Intervention Program.* Mid Continent Research for Education and Learning.

Puentedura, R. (2012). *The SAMR model: Background and exemplars*. Retrieved from http://www.hippasus.com/rrpweblog/archives/2012/08/23/samr_backgroundexemplars.pdf

Puentedura, R. (2014). *SAMR and Bloom's Taxonomy: Assembling the Puzzle.* Retrieved from https://www.graphite.org/blog/samr-and-blooms-taxonomy-assembling-the-puzzle

Purcell, K., Heaps, A., Buchannan, J., & Friedrich, L. (2013) *How teachers are using technology at home and in their classrooms.* Pew Research Internet Project. [Report]. Retrieved from http://www.pewinternet.org/2013/02/28/how-teachers-are-using-technology-at-home-and-in-their-classrooms/

Raphael, L., & Burke, M. (2012). Academic, social, and emotional needs in a middle grades reform initiative. *Research in Middle Level Education Online, 35*(6), 1-13.

Reiser, R. A. & Dempsey, J. V. (2007). *Trends and issues in instructional design and Technology.* San Francisco: Jossey-Bass.

Richardt, R., Church, M., & Morrison, K. (2011). *Making thinking visible: How to promote engagement, understanding, and independence for all learners*. San Francisco, CA: John Wiley & Sons.

Rockoff, J. E., & Lockwood, B. B. (2010). Stuck in the Middle. *Education Next*, *10*(4). Retrieved from http://educationnext.org/stuck-in-the-middle/

Roehlkepartain, E. C., Benson, P. L., King, P. E., & Wagener, L. (2005). *The Handbook of Spiritual development in childhood and adolescence: Moving to the scientific mainstream* (pp. 1-15). Thousand Oaks, CA: Sage Publications.

Roney, K. (2005). Young adolescent development. In V. A. Anfara, Jr., G. Andrews, & S. B. Mertens, (Eds.), *The encyclopedia of middle grades education* (pp. 397-401). Greenwich, CT: Information Age.

Rose, W. J. (2008). *Standards and technology integration among beginning K--8 teachers.* (Doctoral dissertation). Available from ProQuest Dissertations and Theses. (UMI No. 3335061)

Rosenshine, B. (2012). Principles of instruction: research-based strategies that all teachers should know. *American Educator, 36*(1), 12.

Russell, A., Carnegie Council on Adolescent Development, & United States of America. (1996). *Great transitions: Preparing adolescents for a new century*. Washington, DC: Carnegie Council on Adolescent Development.

Saavedra, A. R. & Opfer, V. D. (2012). Learning 21st-century skills requires 21st-century teaching. *Kappa Magazine, 94*(2).

Saulnier, B. M. (2008). From "sage on the stage" to "guide on the side" revisited: (un) covering the content in the learner-centered information systems course. *Information Systems Educ. J*, *7*, 3-10. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.613.6580&rep=rep1&type=pdf

Scott, E. S. (2013). *Secrets from the middle: Making who you are work for you.* Westerville, OH: Association for Middle Level Education.

Scudero, D. (2015). *Opening welcome to Napa Valley Unified School District Learning Wal*k. American Canyon, CA: Napa Valley School District.

Schrum, L. & Glasset, K. F. (2006) *Technology integration in P-12 schools: Challenges to implementation an impact of scientifically-based research.* Retrieved from http://artseducator20.iu1.wikispaces.net/file/view/schrum.pdf/346756304/schrum.pdf

Sharples, M., & Anastopoulou, S. (2012). *Designing orchestration for inquiry learning.* In Littleton, K., Scanlon, E., & Sharples, M. (Eds.), Orchestrating inquiry learning (pp. 69-85). New York, NY: Routledge.

Schrock, K. (2013). *Resources to support the SAMR Model*. Retrieved from http://www.schrockguide.net/samr.html

Sigler, J. W & Hierbert, J. (1999). *The teaching gap: Best ideas from the world's teachers for improving education in the classroom.* New York, NY: The Free Press.

Simmons, R., & Blyth, D. (2008). *Moving into adolescence: The impact of pubertal change and the school context*. New York, NY: Aldine Transaction.

Spires, H., Lee, J. Turner, K. & Johnson, J. (2008). Having our say: Middle grade students perspectives on school, technologies, and academic engagement. *Journal of Research in Technology & Education, 40*(4).

Standish, E. W. (2008). *The impact of two middle school grade level start points, 5th-grade and 7th-grade, on adolescents' 8th-grade achievement, behavior, and high school preparedness* (Doctoral dissertation). Available from ProQuest Dissertations & Theses. (UMI No. 3324660)

Staples, A., Pugach, M. C., & Himes, D. (2005). Rethinking the technology integration challenge: Cases from three urban elementary schools. *Journal of Research on Technology in Education, 37*(3), 285311.

State Educational Technology Directors Association. (2015). *Navigating the digital shift: mapping the acquisition of digital instructional materials.* Retrieved from http://www.setda.org/wp-content/uploads/2015/10/SETDA_Navigating-the-Digital-Shift_full_10.19.15.pdf

Stevenson, C. (2002). *Teaching ten to fourteen year olds* (3rd ed.). Boston, MA: Allyn & Bacon.

Strahan, D., L'Esperance, M., & Van Hoose, J. (2009). *Promoting harmony: Young adolescent development and classroom practices*. Westerville, OH: National Middle School Association.

Strong, J. H., Tucker, P D., & Hindman, J. L. (2004). *Handbook for qualities of effective teachers.* Alexandria, VA: ACSD.

Tanner, J. M. (1973). Growing up. *Scientific American, 229*(3), 35-43.

Taylor, T. (2014*).* Changing pedagogy for modern learners – Lessons from an educator's journey of self-reflection. *Educational Technology & Society, 17*(1), 79–88.

Thornburg, H. (1983). Is early adolescence really a stage of development? *Theory into Practice, 22*, 79-84.

Tileston, D. W. (2004). *What every teacher should know about effective teaching strategies.* Thousand Oaks, CA: Corwin Press.

Tileston, D. W. (2011). *Ten best teaching practices: How brain research and learning styles define teaching competencies* (3rd ed.). Thousand Oaks, CA: Corwin Press.

U.S. Department of Commerce, Economics and Statistics Administration (2011). *Exploring the digital nation: Computer and internet use at home*. (Report). Retrieved from http://www.esa.doc.gov/sites/default/files/ reports /documents /exploringthedigitalnation-computerandinternetuseathome.pdf

U.S. Department of Education. (2010). *Transforming American education: Learning powered by technology—National education technology plan 2010*. Washington,

DC: Office of Educational Technology. Retrieved from http://www.ed.gov/sites/default/files/netp2010.pdf

U.S. Department of Education. (2017). *Use of technology in teaching and learning.* Retrieved from https://www.ed.gov/oii-news/use-technology-teaching-and-learning

Van Orden, J. (2014 *How to podcast tutorial. Promoting your podcast*. Retrieved from http://howtopodcasttutorial.com/index.htm

Véronneau, M. H. & Dishion, T. J. (2010). Middle school friendships and academic achievement in early adolescence: A longitudinal analysis. *Journal of Early Adolescence 3*(1), 99-124. Retrieved from http://jea.sagepub.com.libproxy.chapman.edu/content/31/1/99.full.pdf+html

Velez, A. (2012). *Preparing students for the future--21st century skills.* (Doctoral dissertation). Available from ProQuest Dissertations & Theses database. (UMI No. 3514336)

Wachira, P., & Keengwe, J. (2010). Technology integration barriers: urban school mathematics teachers perspectives. *Journal of Science Education and Technology, 20(*1), 17–25

Wagner, T. (2008). *The global achievement gap: Why even our best schools don't teach the new survival skills our children need—and what we can do about it*. New York, NY: Basic Books.

Wavering, M. J. (1995). *Educating young adolescents: Life in the middle*. New York, NY: Garland Publishing.

Wang, S. K., & Hsu, H. Y. (2008). Use of the webinar tool (elluminate) to support Training: The effects of webinar-learning implementation from student-trainers' perspective. *Journal of Interactive Online Learning, 7*(3), 175-194.

Watson, J., Murin, A., Vashaw, L., Gemin, B., & Rapp, C. (2012). *Keeping pace with K-12 online and blended learning: An annual review of policy and practice*. Evergreen, CO: Evergreen Education Group.

Weiss, C. C., & Kipnes, L. (2006). Reexamining middle school effects: A comparison of middle grades students in middle schools and K–8 schools. *American Journal of Education*, *112*(2), 239-272.

Welmond, M. (2002). Globalization viewed form the periphery: The dynamics of teacher identity in the Republic of Benin. *Comparative Education Review 46*(1), 28.

Wiles, J., Bondi, J., & Wiles, M. T. (2006). *The essential middle school* (4th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.

Windschitl, M., & Sahl, K. (2002, Spring). Tracing teachers' use of technology in a laptop computer school: The interplay of teacher beliefs, social dynamics, and institutional culture. *American Educational Research Journal, 39* (1), 165-205.

Wenglinsky, H. (2005). *Using technology wisely: The keys to success in schools.* New York, NY. Teachers College Press.

Wetzel, K., & Marshall, S. (2011). TPACK goes to sixth grade: Lessons from a middle school teacher in a high-technology-access classroom. *Journal of Digital Learning in Teacher Education*, *28*(2), 73-81.

Williams, A. (2015) *Meet Alpha: The next 'next generation.'* New York Times. Retrieved from https://www.nytimes.com/2015/09/19/fashion/meet-alpha-the-next-next-generation.html?_r=0

Williamson, J. & Redish, T. (2009). *ISTE's technology facilitation and leadership standards: what every k-12 leader should know and be able to do*. Eugene, OR: International Society for Technology in Education.

Wong, K. K. (2012). Book Review. *Saving schools: From Horace Mann to virtual learning by Paul E. Peterson.* Retrieved from http://www.jstor.org/stable /10.1086/666381

Wood, J. C. M. (2008). *The impact of globalization on education reform: A case study of Uganda.* (Doctoral dissertation). Available at ProQuest Dissertations and Theses database. (UMI No. 337946)

Yecke, C. P. (2005). Mayhem in the middle. Washington, DC: Fordham Institute. Retrieved from ERIC database. (ED499797)

APPENDICES

APPENDIX A - SYNTHESIS MATRIX

Theme -Questions/Authors	21st Century Partnership (2008)	Ito, et.al. (2008)	Ito, M (2013)	Friedman & Mandelbaum (2011)	Glick, 2014	Detwiller (2007)	Krashen (2014	Bellanca & Brandt (2010)	Calif. Dept. of Education (2013)	Conley (2011)	Conley, drummond, Gonzalez, Rooseboom, & Stout (2011)	Dede (2009)
Technology history purpose	X			X								
21st century skills needed		X		X				X				
Technology natives		X	X									
Teaching strategies needing change	X	X		X								
Brain research in types of learning enviornments needed					X							
Development of schools to align with technology needs and 21st century skill development						X		X				
Facilities needing change/restructuring						X						
Common core - strategies							X			X		
Rethinking how students learn - 21st century skills								X				
Common core - best practices									X			
opposing view on common core							X					
College and career ready?										X	X	
Need to prepare students for college and career	X			X						X	X	
Common core overview/information									X	X	X	
How ready are futrue ready students?												X
Student national data												
Essentials of project based learning												
Common Core pilot test results												
21st century learning with technology												
21st Century Teaching needed												
What is 21st century teaching												
How to teach 21st century skills												
Middle school technolgoy integegration perception												

Theme -Questions/Authors	21st Century Partnership (2008)	Ito, et.al. (2008)	Ito, M (2013)	Friedman & Mandelbaum (2011)	Glick, 2014	Detwiller (2007)	Krashen (2014	Bellanca & Brandt (2010)	Calif. Dept. of Education (2013)	Conley (2011)	Conley, drummond, Gonzalez, Rooseboom, & Stout (2011)	Dede (2009)
Improve education with laptops in the hands of 7th graders												
new generation		X										
Technology in education needed		X	X									
What if there were no computers												
Education technology who is leading the way												
Education technolgy why is it important		X										
Educatation technology how do we implement												
Education technology what do the experts say												
US Pulic Schools Statistics												

Theme -Questions/Authors	Dept of Education (2013)	Larmer & Mergendoller (2011)	Michalec (2013)	NVUSD (2013)	Pearlman (2006)	Peterson (2010)	Regan (2008)	Weiner, Aspen, et. al. (2103)	Wong (2012)	Grathwait & Weller (2005)	Ellis (2013)	Spires. Lee & Turner (2008)	Wells (2006)
Technology history purpose						X	X		X				
21st century skills needed						X	X						
Technology natives													
Teaching strategies needing change													
Brain research in types of learning enviornments needed													
Development of schools to align with technology needs and 21st century skill development													
Facilities needing change/restructuring													
Common core - strategies													
Rethinking how students learn - 21st century skills													
Common core - best practices			X										
opposing view on common core													
College and career ready?													
Need to prepare students for college and career													
Common core overview/information								X					
How ready are futrue ready students?													
Student national data	X												
Essentials of project based learning		X											
Common Core pilot test results				X									
21st century learning with technology					X								
21st Century Teaching needed													
What is 21st century teaching													
How to teach 21st century skills							X				X		
Middle school technolgoy inteegration perception													

Theme -Questions/Authors	Dept of Education (2013)	Larmer & Mergendoller (2011)	Michalec (2013)	NVUSD (2013)	Pearlman (2006)	Peterson (2010)	Regan (2008)	Weiner, Aspen, et. al. (2103)	Wong (2012)	Grathwait & Weller (2005)	Ellis (2013)	Spires. Lee & Turner (2008)	Wells (2006)
Improve education with laptops in the hands of 7th graders										X			
new generation											X	X	
Technology in education needed										X		X	
What if there were no computers													X
Education technology who is leading the way										X			
Education technolgy why is it important									X	X	X	X	
Educatation technology how do we implement													
Education technology what do the experts say													
US Pulic Schools Statistics													

Theme -Questions/Authors	Saavedra & Opfer (2012	Velez (2012)	James (2009)	U.S. Dept of Commerce (2002)
Technology history purpose				
21st century skills needed		X		
Technology natives		X	X	
Teaching strategies needing change				
Brain research in types of learning enviornments needed				
Development of schools to align with technology needs and 21st century skill development		X		
Facilities needing change/restructuring				
Common core - strategies				
Rethinking how students learn - 21st century skills		X		
Common core - best practices				
opposing view on common core				
College and career ready?				
Need to prepare students for college and career				
Common core overview/information				
How ready are futrue ready students?				
Student national data				x
Essentials of project based learning				
Common Core pilot test results				
21st century learning with technology				
21st Century Teaching needed	X	X		
What is 21st century teaching	X			
How to teach 21st century skills				
Middle school technolgoy inteegration perception			X	

Theme -Questions/Authors	Saavedra & Opfer (2012	Velez (2012)	James (2009)	U.S. Dept of Commerce (2002)
Improve education with laptops in the hands of 7th graders				
new generation			X	
Technology in education needed			X	
What if there were no computers				
Education technology who is leading the way				
Education technolgy why is it important				
Educatation technology how do we implement				
Education technology what do the experts say				x
US Pulic Schools Statistics				

APPENDIX B – EXPERT TECHNOLOGY INTEGRATION TEACHER SURVEY

Copy of Best Practice Implementation of Middle School Technology

Participant Agreement

* 1. INFORMATION ABOUT: Technology Integration: A Mixed Methods Study of Best Practices Used By Middle School Teachers Identified as Experts of Technology Integration in Middle Schools.

RESPONSIBLE INVESTIGATOR: Carliza Bataller Brannen

THE FOLLOWING WILL BE INCLUDED IN THE ELECTRONIC SURVEY:
You are being asked to participate in a research study conducted by Carliza Bataller Brannen, a Doctoral student at Brandman University. The purpose of this mixed methods study is to identify and describe best practices in technology integration in middle schools. Additionally it is the purpose of the study to determine the most important best practices and perceived barriers to successful technology integration as perceived by expert middle school teachers or technology.

Your participation in this survey is voluntary. You may choose not to participate. If you decide to participate in this electronic survey, you can withdraw at any time.

The survey will take approximately 20 minutes to complete. Your responses will be confidential. The survey questions will pertain to your perceptions regarding best practices in technology integration in middle schools.

I understand that no information that identifies me will be released without my separate consent and 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. There are minimal risks associated with participating in this research. I understand that the Investigator will protect my confidentiality by keeping the identifying codes and research materials in a locked file drawer that is available only to the researcher. I understand that I may refuse to participate in or I may withdraw from this study at any time without any negative consequences. I understand that if I have any question, comments, or concerns about the study or the informed consent process, I may write or call the Office of the Vice Chancellor of Academic Affairs, Brandman University, at 16355 Laguna Canyon Rd, Irvine CA 92618 (949) 341-7641.

If you have any questions about completing this survey or any aspects of this research, please contact Carliza Bataller Brannen at bata8801@mail.brandman.edu or by phone at (707) 592-4256; or Dr. Cindy Petersen, Advisor, at cpeterse@brandman.edu

Clicking on the "agree" button indicates that you have read this informed consent form and the information in this document and that you voluntarily agree to participate.

If you do not wish to participate in this electronic survey, you may decline participation by clicking on the "disagree" button.

1

1. Approximately how often do you use technology for instructional purposes (not PowerSchool or email)? Choose an item.

- ◯ Daily in each class
- ◯ Every other class
- ◯ Three times a week
- ◯ At least two times a week
- ◯ At least once a week

2. Approximately how often do students use technology in your instructional setting? Choose an item.

- ◯ Daily in each class
- ◯ Every other class
- ◯ Three times a week
- ◯ At least two times a week
- ◯ At least once a week

3. Check each selection pertains to how you model digital citizenship (ISTE Standard 2):

- ☐ I advocate modeling, and teaching the safe, legal, and ethical use of digital information and technology.
- ☐ I model and expect students to use appropriate documentation of sources on projects.
- ☐ I discuss and model the importance of copyright and the ethical use of digital information with students.
- ☐ I discuss and model the importance of Internet safety with students.
- ☐ I provide equitable access to technology for all students.

4. Check the sentence that best describes your use of digital tools and resources (ISTE Standard 6):

- ◯ I seamlessly integrate the use of digital tools and resources for communication, production, collaboration, and instruction in a technology enriched learning environment.
- ◯ I use a variety of digital tools for collaboration with colleagues and/or students (computer microphones, digital cameras, web cams, digital storytelling software, wikis, and blogs).
- ◯ I use staff and student shared folders and/or Blackboard to share teacher designed learning activities that use productivity software and websites for information sharing and/or collaboration.
- ◯ I design learning activities for students that use productivity software and websites.
- ◯ I use email, productivity software (word processing, spreadsheet, database, and/or presentation software) and websites for personal/instructional use.

5. Select the level that best describes how you use technology interactively. (ISTE Standards 1, 2, 6, 7)

- ☐ I utilize and create lessons and assessments that engage students through interactive technologies that advance student learning and creativity (interactive boards, wireless devices, and individual response systems).
- ☐ I utilize lessons and assessments that engage students through interactive technologies (interactive boards, wireless devices, and individual response systems).
- ☐ I utilize lessons that engage students through interactive technologies (interactive boards and/or wireless devices).
- ☐ I use interactive technology primarily for ~~presentation, and~~ am working toward interactive use with students.
- ☐ I use interactive technology primarily for presentation.

6. Check the sentence that best describes your students' learning experiences and assessments (ISTE Standard 1):

- ☐ I design a digital learning environment where students are active participants in setting their own educational goals, managing their learning and assessing their own progress.
- ☐ I design, monitor and assess the digital learning environment that provides the experiences which enable students to pursue their individual curiosity.
- ☐ I design customized and personalized learning experiences based on achievement data.
- ☐ I design learning experiences using digital tools to address diverse learning styles.
- ☐ I design learning experiences that incorporate the use of various digital tools.

7. Check the sentence that best describes how you and your students use technology for research and problem solving (ISTE Standards 3, 4):

- ☐ I assign projects that require students to search for and evaluate information through electronic resources and other appropriate technologies exploring real world issues and authentic problems.
- ☐ I assign projects that require students to locate information electronically and give credit by citing sources.
- ☐ I assign questions that can be answered through a search of student located electronic resources and other appropriate technologies with limited assistance.
- ☐ I assign questions that can be answered through a search of teacher-selected electronic resources.
- ☐ I show students electronic resources that relate to topics they are studying.

8. Check any of the following technology applications you use with your students (ISTE Standards 4, 5, 6, 7):

- [ ] Word Processors (Word)
- [ ] Interactive White Board (SMARTboard, Promethean)
- [ ] Spreadsheets and Graphing (Excel)
- [ ] Databases (Access)
- [ ] Podcasting / Vodcasting/Webinar (Audacity, Garage Band, MovieMaker, Photostory, AdobeConnect, etc.)
- [ ] Blackboard applications (on-line testing, wikis, blogs, etc.)
- [ ] Web page creation
- [ ] Games (tutorial and basic skills development)
- [ ] Special Applications for Reading, Math, etc. (e.g., Accelerated Reader, Larson)
- [ ] World Wide Web/Internet
- [ ] Other (please specify)

- [ ] Presentation Software (e.g., PowerPoint, Hyperstudio) Inspiration, Timeliner
- [ ] United Streaming (ETV Streamline)
- [ ] 'Clickers' (Class Performance System or Senteo)
- [ ] CD-Rom Encyclopedias
- [ ] Graphing Calculators
- [ ] Probes for data acquisition (temperature, mass, etc.)
- [ ] GPS / Geocaching
- [ ] Learning Management System

9. Check any of the following needs of early adolescents you incorporate into your technology-integrated lesson: (ISTE 3, 4, 5)

- [ ] Positive social interaction with adults and peers
- [ ] Physical activity
- [ ] Structure and clear limits
- [ ] Creative expression
- [ ] Competence and achievement
- [ ] Meaningful participation in families, school, and communities
- [ ] Opportunities for self-definition

10. Check any of the following needs of the digital generation you incorporate into your technology-integrated lesson (ISTE Standards 1, 3, 4, 5):

- [ ] Frequent transitions during class
- [ ] Student choice / flexible curriculum around interests of student
- [ ] Social-based activities (cooperative learning, wikis, games, etc.)
- [ ] Digital literacy (how to use software, choose valid resources on Internet, etc.)
- [ ] Visually / Media-rich teaching resources

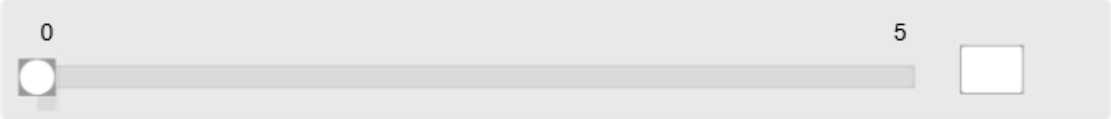
11. Check any of the following 21st Century Skills you incorporate into your technology-integrated lessons (ISTE Standards 1, 3, 4, 5, 7):

- [ ] Core content
- [ ] Critical thinking / Problem-solving
- [ ] Communication skills
- [ ] Creativity / Letting students think outside of the box
- [ ] Digital literacy (how to use software, choose valid resources on Internet, etc.)
- [ ] Leadership / Accountability
- [ ] Ethics / Social responsibility
- [ ] Personal accountability / Goal-setting and evaluation

12. ISTE Standards 1,2,7

On a scale from 1 (low importance) to 5 (high importance), please rate how important the following practice is to support student success as it pertains to how you model digital citizenship:

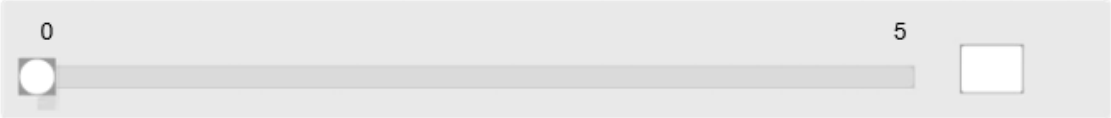
I advocate modeling, and teaching the safe, legal, and ethical use of digital information and technology.



13. ISTE Standards 1,2,7

On a scale from 1 (low importance) to 5 (high importance), please rate how important the following practice is to support student success as it pertains to how you model digital citizenship:

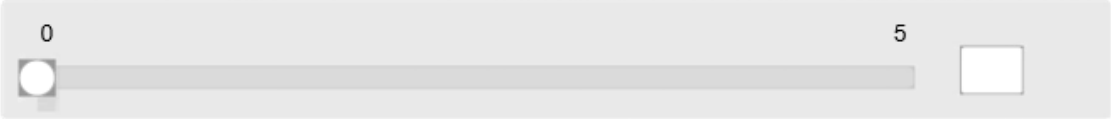
I model and expect students to use appropriate documentation of sources on projects.



14. ISTE Standards 1,2,7

On a scale from 1 (low importance) to 5 (high importance), please rate how important the following practice is to support student success as it pertains to how you model digital citizenship:

I discuss and model the importance of copyright and the ethical use of digital information with students.



15. ISTE Standards 1,2,7

On a scale from 1 (low importance) to 5 (high importance), please rate how important the following practice is to support student success as it pertains to how you model digital citizenship:

I discuss and model the importance of Internet safety with students.

16. ISTE Standards 1,2,7

On a scale from 1 (low importance) to 5 (high importance), please rate how important the following practice is to support student success as it pertains to how you model digital citizenship:

I provide equitable access to technology for all students.

17. ISTE Standards 4, 5, 6, 7

On a scale from 1 (low importance) to 5 (high importance), please rate how important the following practice is to support student success and best describes your use of digital tools and resources:

I seamlessly integrate the use of digital tools and resources for communication, production, collaboration, and instruction in a technology enriched learning environment.

18. ISTE Standards 4, 5, 6, 7

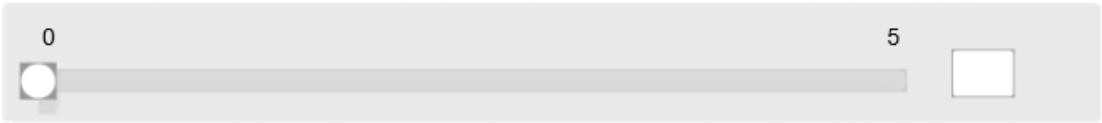
On a scale from 1 (low importance) to 5 (high importance), please rate how important the following practice is to support student success and best describes your use of digital tools and resources:

I use a variety of digital tools for collaboration with colleagues and/or students (computer microphones, digital cameras, web cams, digital storytelling software, wikis, and blogs).

19. ISTE Standards 4, 5, 6, 7

On a scale from 1 (low importance) to 5 (high importance), please rate how important the following practice is to support student success and best describes your use of digital tools and resources:

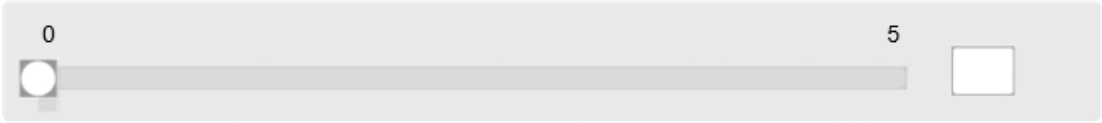
I use staff and student shared folders and/or Blackboard to share teacher designed learning activities that use productivity software and websites for information sharing and/or collaboration.



20. ISTE Standards 4, 5, 6, 7

On a scale from 1 (low importance) to 5 (high importance), please rate how important the following practice is to support student success and best describes your use of digital tools and resources:

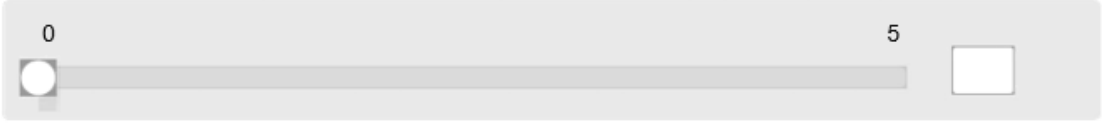
I design learning activities for students that use productivity software and websites.



21. ISTE Standards 4, 5, 6, 7

On a scale from 1 (low importance) to 5 (high importance), please rate how important the following practice is to support student success and best describes your use of digital tools and resources:

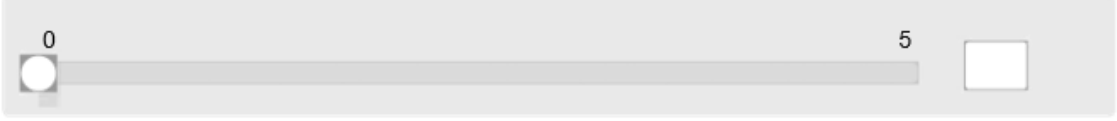
I use email, productivity software (word processing, spreadsheet, database, and/or presentation software) and websites for personal/instructional use.



22. ISTE Standards 4, 5, 6, 7

On a scale from 1 (low importance) to 5 (high importance), please rate how important the following practice is to support student success and best describes your use of digital tools and resources:

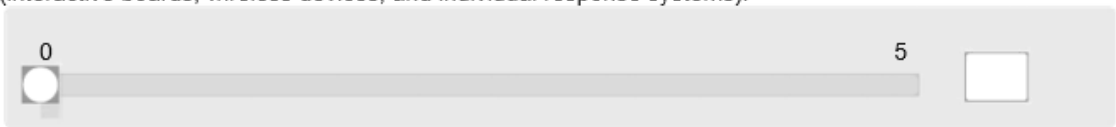
I utilize and create lessons and assessments that engage students through interactive technologies that advance student learning and creativity (interactive boards, wireless devices, and individual response systems).



23. ISTE Standards 1, 2, 6, 7

On a scale from 1 (low importance) to 5 (high importance), please rate how important the following practice is to support student success in meeting the learning objective goal while using technology interactively:

I utilize lessons and assessments that engage students through interactive technologies (interactive boards, wireless devices, and individual response systems).



23. ISTE Standards 1, 2, 6, 7

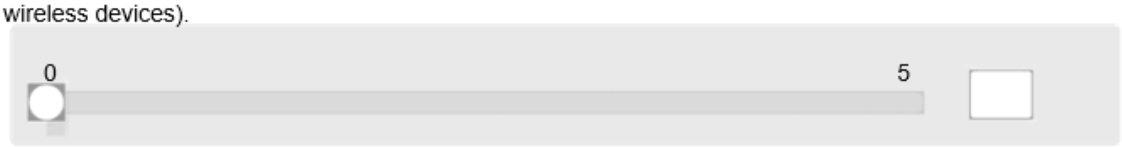
On a scale from 1 (low importance) to 5 (high importance), please rate how important the following practice is to support student success in meeting the learning objective goal while using technology interactively:

I utilize lessons and assessments that engage students through interactive technologies (interactive boards, wireless devices, and individual response systems).

24. ISTE Standards 1, 2, 6, 7

On a scale from 1 (low importance) to 5 (high importance), please rate how important the following practice is to support student success in meeting the learning objective goal while using technology interactively:

I utilize lessons that engage students through interactive technologies (interactive boards and/or wireless devices).



25. ISTE Standards 1, 2, 6, 7

On a scale from 1 (low importance) to 5 (high importance), please rate how important the following practice is to support student success in meeting the learning objective goal while using technology interactively:

I use interactive technology primarily for presentation, and am working toward interactive use with students.

0 5

26. ISTE Standards 1, 2, 6, 7

On a scale from 1 (low importance) to 5 high importance, please rate how important the following practice is to support student success in meeting the learning objective goal while using technology interactively:

I use interactive technology primarily for presentation.

0 5

27. ISTE Standards 1,5,6

On a scale from 1 to 5, how important is the following practice to support effective student learning experiences and assessments (1 = low importance to 5 = high importance):

I design a digital learning environment where students are active participants in setting their own educational goals, managing their learning and assessing their own progress.

28. ISTE Standards 1,5,6

On a scale from 1 to 5, how important is the following practice to support effective student learning experiences and assessments (1 = low importance to 5 = high importance):

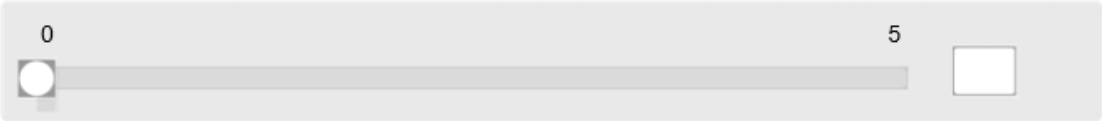
I design, monitor and assess the digital learning environment that provides the experiences which enable students to pursue their individual curiosity.

0 5

29. ISTE Standards 1,5,6

On a scale from 1 to 5, how important is the following practice to support effective student learning experiences and assessments (1 = low importance to 5 = high importance):

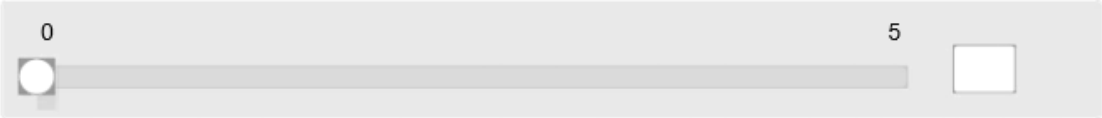
I design customized and personalized learning experiences based on achievement data.



30. ISTE Standards 1,5,6

On a scale from 1 to 5, how important is the following practice to support effective student learning experiences and assessments (1 = low importance to 5 = high importance):

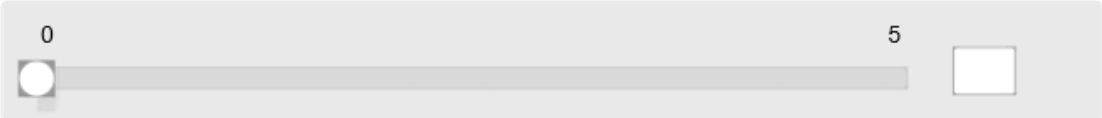
I design customized and personalized learning experiences based on achievement data.



31. ISTE Standards 1,5,6

On a scale from 1 to 5, how important is the following practice to support effective student learning experiences and assessments (1 = low importance to 5 = high importance):

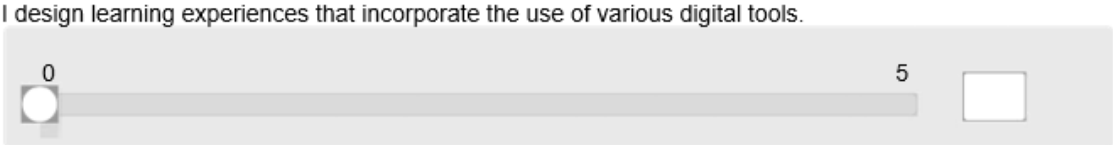
I design learning experiences using digital tools to address diverse learning styles.



32. ISTE Standards 1,5,6

On a scale from 1 to 5, how important is the following practice to support effective student learning experiences and assessments (1 = low importance to 5 = high importance):

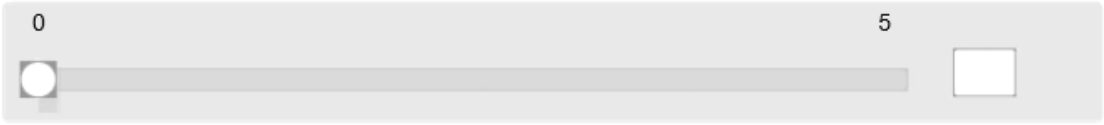
I design learning experiences that incorporate the use of various digital tools.



33. ISTE Standards 3, 4

On a scale from 1 to 5, how important is the following practice to support student success in meeting the learning objective/skill development goal with the use of technology for research and problem solving (1 = low importance to 5 = high importance):

I assign projects that require students to search for and evaluate information through electronic resources and other appropriate technologies exploring real world issues and authentic problems.



34. ISTE Standards 3, 4

On a scale from 1 to 5, how important is the following practice to support student success in meeting the learning objective/skill development goal with the use of technology for research and problem solving (1 = low importance to 5 = high importance):

I assign projects that require students to locate information electronically and give credit by citing sources.

35. ISTE Standards 3, 4

On a scale from 1 to 5, how important is the following practice to support student success in meeting the learning objective/skill development goal with the use of technology for research and problem solving (1 = low importance to 5 = high importance):

I assign questions that can be answered through a search of student located electronic resources and other appropriate technologies with limited assistance.

36. ISTE Standards 3, 4

On a scale from 1 to 5, how important is the following practice to support student success in meeting the learning objective/skill development goal with the use of technology for research and problem solving (1 = low importance to 5 = high importance):

I assign questions that can be answered through a search of teacher-selected electronic resources.

37. ISTE Standards 3, 4

On a scale from 1 to 5, how important is the following practice to support student success in meeting the learning objective/skill development goal with the use of technology for research and problem solving (1 = low importance to 5 = high importance):

I show students electronic resources that relate to topics they are studying.

38. ISTE Standards 1, 3, 5, 6, 7

On a scale from 1 to 5, how important are the following technology applications to support student success in meeting learning objective/skill development goal (1 = low importance to 5 = high importance):

	1 Low Importance	2 Some Importance	3 Important	4 Strong Importance	5 High Importance	N/A
Word Processors (Word)	○	○	○	○	○	○

Interactive White Board (SMARTboard, Promethean)	☐	☐	☐	☐	☐	☐
Spreadsheets and Graphing (Excel)	☐	☐	☐	☐	☐	☐
Databases (Access)	☐	☐	☐	☐	☐	☐
Podcasting / Vodcasting/Webinar (Audacity, Garage Band, MovieMaker, Photostory, AdobeConnect, etc.)	☐	☐	☐	☐	☐	☐
Blackboard applications (on-line testing, wikis, blogs, etc.)	☐	☐	☐	☐	☐	☐
Web page creation	☐	☐	☐	☐	☐	☐
Games (tutorial and basic skills development)	☐	☐	☐	☐	☐	☐
Special Applications for Reading, Math, etc. (e.g., Math 180, Read 180, Systems 44, Accelerated Reader, Larson)	☐	☐	☐	☐	☐	☐
World Wide Web/Internet	☐	☐	☐	☐	☐	☐
Presentation Software (e.g., PowerPoint, Google Slides, Prezi, Hyperstudio, Infographic)	☐	☐	☐	☐	☐	☐
Brainstorm/Organization Applications (e.g., Inspiration, Timeliner)	☐	☐	☐	☐	☐	☐
United Streaming (ETV Streamline)	☐	☐	☐	☐	☐	☐
'Clickers' (Class Performance System or Senteo)	☐	☐	☐	☐	☐	☐
CD-Rom Encyclopedias	☐	☐	☐	☐	☐	☐
Graphing Calculators	☐	☐	☐	☐	☐	☐

	1 Low Importance	2 Some Importance	3 Important	4 Strong Importance	5 High Importance	N/A
Probes for data acquisition (temperature, mass, etc.)	☐	☐	☐	☐	☐	☐
Learning Management System	☐	☐	☐	☐	☐	☐

39. ISTE Standards 2 & 5

On a scale of 1 to 5, how important is it to incorporate the following needs of early adolescents into your technology-integrated lesson; (1 = low importance to 5 = high importance):

	1 Low Importance	2 Some Importance	3 Important	4 Strong Importance	5 High Importance	N/A
Positive social interaction with adults and peers	☐	☐	☐	☐	☐	☐
Structure and clear limits	☐	☐	☐	☐	☐	☐
Physical activity	☐	☐	☐	☐	☐	☐
Creative expression	☐	☐	☐	☐	☐	☐
Competence and achievement	☐	☐	☐	☐	☐	☐
Meaningful participation in families, school, and communities	☐	☐	☐	☐	☐	☐
Opportunities for self-definition	☐	☐	☐	☐	☐	☐

40. On a scale of 1 to 5, how important are the following needs of the digital generation and need to be incorporated into your technology-integrated lesson; ISTE Standards 1, 6 (1 = low importance to 5 = high importance):

	1 Low Importance	2 Some Importance	3 Important	4 Strong Importance	5 High Importance	N/A
Frequent transitions during class	☐	☐	☐	☐	☐	☐
Student choice / flexible curriculum around interests of student	☐	☐	☐	☐	☐	☐
Social-based activities (cooperative learning, wikis, games, etc.)	☐	☐	☐	☐	☐	☐
Digital literacy (how to use software, choose valid resources on Internet, etc.)	☐	☐	☐	☐	☐	☐
Visually / Media-rich teaching resources	☐	☐	☐	☐	☐	☐

41. On a scale of 1 to 5 (1 = low importance to 5 = high importance), how important is it to incorporated any of the following 21st Century Skills into your technology-integrated lesson; ISTE Standards 3,5,7:

	1 Low Importance	2 Some Importance	3 Important	4 Strong Importance	5 High Importance	N/A
Core Content	☐	☐	☐	☐	☐	☐
Critical Thinking/Problem-Solving	☐	☐	☐	☐	☐	☐
Communication Skills	☐	☐	☐	☐	☐	☐
Creativity/Letting STudents Think Outside of the Box	☐	☐	☐	☐	☐	☐
Digital Literacy (how to use software, choose valid resources on Internet, etc.)	☐	☐	☐	☐	☐	☐
Leadership/Accountability	☐	☐	☐	☐	☐	☐
Ethics/Social Responsibility	☐	☐	☐	☐	☐	☐
Personal Accountability/Goal-Setting and Evaluation	☐	☐	☐	☐	☐	☐

42. Describe your most successful technology-based lesson/learning activity in regards to student engagement and achievement.

43. Why do you think your students were so engaged in this lesson/learning activity?

44. How did you judge its effectiveness as far as student achievement?

45. Describe the technology-based tools used and for what purpose?

46. What skills did you have to teach the students in order to use the technology integrated into the lesson/learning activity?

47. Please select your response by indicating the impact of the following on integrating technology into teaching and learning:

	No Impact	Little Impact	Neutral: Some Impact	High Impact	N/A
No Time (to develop, to implement, to communicate with students, etc.)	☐	☐	☐	☐	☐
Lack of technology resources (hardware, network, and/or software)	☐	☐	☐	☐	☐
Inadequate support (training or staff at the school)	☐	☐	☐	☐	☐
Teacher reward structure including compensation, incentives, etc.	☐	☐	☐	☐	☐
Funding to keep up with technological changes	☐	☐	☐	☐	☐
Job security issues (teachers will be replaced by technology)	☐	☐	☐	☐	☐
Ability to teach and use technical content at a distance	☐	☐	☐	☐	☐
Funds to implement instructional technology	☐	☐	☐	☐	☐
Lack of student competency and skills	☐	☐	☐	☐	☐
Lack of recognition	☐	☐	☐	☐	☐
Professional development for teachers with rewards and incentives	☐	☐	☐	☐	☐

Time commitment to learning and implementing new technology	☐	☐	☐	☐	☐
Unrealistic expectations by administrators	☐	☐	☐	☐	☐
Not enough time for students to be at computers	☐	☐	☐	☐	☐
Equipment difficulties	☐	☐	☐	☐	☐
Scheduling when computer labs are available	☐	☐	☐	☐	☐
Software compatibility and availability	☐	☐	☐	☐	☐
Internet connectivity	☐	☐	☐	☐	☐
Large class size	☐	☐	☐	☐	☐

Research Question 1:

What are the best practices in technology integration in middle school classes as perceived by experts middle school teachers?

Survey question number that pertains to Research Question 1:
4, 5, 6, 7, 8, 9, 10, 11, 12
Source:

ISTE (2016) Standard for Students relating to Survey question that pertain to Research Question 1:

ISTE Standard	Survey Questions that relate to ISTE Standard
ISTE Standard 1	6, 7, 11, 12
ISTE Standard 2	4, 6,
ISTE Standard 3	8, 10, 11, 12
ISTE Standard 4	8, 9, 10, 11, 12
ISTE Standard 5	9, 10, 11, 12
ISTE Standard 6	5, 6, 9
ISTE Standard 7	6, 9, 12

Research Question 2:

What are the most important best practices in technology integration in middle school classes as perceived by experts middle school teachers s?

Survey question that pertains to Research Question 2:

13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25

ISTE Standard relating to Survey question that pertain to Research question 2:

ISTE Standard	Survey Questions that relate to ISTE Standard
ISTE Standard 1	13, 15, 16, 19
ISTE Standard 2	13, 15, 18
ISTE Standard 3	17, 20
ISTE Standard 4	14, 17,
ISTE Standard 5	14, 16, 18, 20
ISTE Standard 6	14, 15, 16, 19
ISTE Standard 7	13, 14, 15, 20

Research Question 3:

What are barriers to successful technology integration in middle school as perceived by experts middle school teachers?

Survey Questions that pertain to Research Question 3:

Please select your response by indicating the impact of the following on integrating technology into teaching and learning:
No Impact -1
Little Impact -2
Neutral Some Impact -3
High Impact -4

1. No Time (to develop, to implement, to communicate with students, etc.)
2. Lack of technology resources (hardware, network, and/or software)
3. Inadequate support (training or staff at the school)
4. Teacher reward structure including compensation, incentives, etc.
5. Funding to keep up with technological changes
6. Job security issues (teachers will be replaced by technology)
7. Ability to teach and use technical content at a distance
8. Funds to implement instructional technology
9. Lack of student competency and skills
10. Lack of recognition
11. Professional development for teachers with rewards and incentives
12. Time commitment to learning and implementing new technology
13. Unrealistic expectations by administrators
14. Not enough time for students to be at computers
15. Equipment difficulties
16. Scheduling when computer labs are available
17. Software compatibility and availability
18. Internet connectivity
19. Large class size

APPENDIX C – INFORMED CONSENT AND BILL OF RIGHTS

BRANDMAN UNIVERSITY INSTITUTIONAL REVIEW BOARD
RESEARCH PARTICIPANTS BILL OF RIGHTS

STUDY: Technology Integration: A Mixed methods Study of Best Practices Used by Middle School Teachers Identified as Experts of Technology Integration in Middle Schools

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 Board 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.

Participant Invitation and Informed Consent

DATE:

Dear <Identified Expert Middle School Teacher>…

My name is Carliza Bataller and I am a Doctoral Candidate in the School of Education at Brandman University. I am conducting a study to discover the practices of expert middle school teachers of technology integration. This letter serves as an invitation for you as a teacher who has been identified as expert by your Superintendent or Principal, to participate in a research study.

PURPOSE: The purpose of this mixed methods study is to identify and describe best practices in technology integration in middle schools. Additionally, it is the purpose of the study to determine the most important best practices and perceived barriers to successful technology integration as perceived by expert middle school teachers of technology. Results from this study will be summarized in a doctoral dissertation.

PROCEDURES: If you choose to participate in this study, you will be asked to participate in an approximately 20-minute electronic survey regarding middle school technology integration. Additionally, I will be asking for volunteers willing to participate in a follow up interview to further discuss and add depth to my findings. (You will be prompted to provide your name and contact information at the end of the survey if you are interested in participating.) If you should choose to participate, the approximately 30 to 45-minute interview will be audio-recorded for transcription purposes.

RISKS, INCONVENIENCES, AND DISCOMFORTS: There are no major risks regarding your participation in this research study. The survey is sent digitally and if chosen, the interview will be scheduled at a time and place which is convenient for you.

POTENTIAL BENEFITS: There are no major benefits to you for participating; nonetheless, a potential benefit may be that you will have an opportunity to identify future best practices for middle school technology integration. The information from this study is intended to inform teachers, researchers, and leaders on the topic of best practice middle school technology integration.

ANONYMITY: If you agree to participate in the survey and/or the interview, you can be assured that it will be completely confidential. The survey is in *SurveyMonkey* and is anonymous. No names will be attached to any notes or records from interviews. All information will remain in locked files, accessible only to the researchers. No employer will have access to specific survey data or interview information. You will be free to stop the survey and/or interview and withdraw from the study at any time. You are also encouraged to ask any questions that will help you understand how this study will be performed and/or how it will affect you. Feel free to contact the principal investigator, Carliza Bataller, at XXXXXXXX or by phone at XXX-XXX-XXXX, to answer any questions or concerns you may have. If I have any questions, comments, or concerns about the study or your rights as a participant, you may write or call the Office of the Vice Chancellor of Academic Affairs, Brandman University, at 16355 Laguna Canyon Road, Irvine, CA 92618, 949-341-7641.

Sincerely,
Carliza Bataller
Brandman University

Consent to Participate in a Research Study
Adult Participants

IRB Study # _____
Consent Form Version Date: July 30, 2017

Title of Study: Technology Integration: Teaching Strategies, Best Practices, and Technology Tools Used by Teachers Identified as Experts in Technology Integration in Middle Schools
Principal Investigator: Carliza Bataller
Study Contact Phone Number: (707) xxx-xxxx
Study Contact Email: xxxx@
Faculty Advisor: Dr. Cindy Petersen
Advisor Phone Number: (xxx)xxx-xxxx
Faculty Advisor Email: xxxx@.org

What is some general information you should know about research studies?
You are being asked to take part in a research study. To join the study is voluntary. You may refuse to join, or you may withdraw your consent to be in the study for any reason, without penalty.

Research studies are designed to obtain new knowledge. This new information may help people in the future. You may not receive any direct benefit from being in the research study. There also may be risks to being in research studies.

Details about this study are discussed below. It is important that you understand this information so that you can make an informed choice about being in this research study.

You will be given a copy of this consent form. You should ask the researchers named above any questions you have about this study at any time.

What is the purpose of this study?
The purpose of this mixed methods study is to identify and describe best practices in technology integration in middle schools. Additionally, it is the purpose of the study to determine the most important best practices and perceived barriers to successful technology integration as perceived by expert middle school teachers of technology. Results from this study will be summarized in a doctoral dissertation.

What if you have questions about this study?
You have the right to ask and have answered any questions you may have about this research. If you have questions or concerns, you should contact the researchers listed on the first page of this form.

Participant's Agreement:

I have read and fully understand the consent form. I have asked all the questions I have at this time. I have received a copy of this form. I voluntarily agree to participate in this research study.

Date:_____Time:_____(a.m. / p.m.)

_____ Signature of Research Participant

_____ Printed Name of Research Participant

Thank you of helping me with this study.

APPENDIX D – INFORMED CONSENT AND INTERVIEW PROTOCOL

Brandman University

Interview Informed Consent & Interview Protocol

INFORMATION ABOUT: Technology Integration: A Mixed methods Study of Best Practices Used by Middle School Teachers Identified as Experts of Technology Integration in Middle Schools.

RESPONSIBLE INVESTIGATOR: Carliza Bataller

OVERVIEW:
You are being asked to participate in a research study conducted by Carliza Bataller, a Doctoral student at Brandman University. The purpose of this mixed methods study is to identify and describe best practices in technology integration in middle schools. Additionally, it is the purpose of the study to determine the most important best practices and perceived barriers to successful technology integration as perceived by expert middle school teachers or technology.

Your participation in this interview is voluntary. You may choose not to participate. If you decide not to participate in this research, you can withdraw at any time.

The interview will take approximately 30 - 45 minutes to complete. Your responses will be confidential. The interview questions will pertain to your perceptions regarding best practices in technology integration in middle schools.

I understand that:

a) There are minimal risks associated with participating in this research. I understand that the Investigator will protect my confidentiality by keeping the identifying codes and research materials in a locked file drawer that is available only to the researcher.
b) I understand that the interview will be audio recorded. The recordings will be available only to the researcher and the professional transcriptionist. The audio recordings will be used to capture the interview dialogue and to ensure the accuracy of the information collected during the interview. All information will be identifier-redacted and my confidentiality will be maintained. Upon completion of the study all recordings, transcripts and notes taken by the researcher and transcriptionist from the interview will be destroyed.
c) The possible benefit of this study is that this research may help add to the research regarding best practices in middle school technology integration. The findings will be available to me at the conclusion of the study and may provide new insights about the best practices of middle school technology integration. I understand that I will not be compensated for my participation.
d) If you have any questions about completing this survey or any aspects of this research, please contact Carliza Bataller at xxx mail.brandman.edu or by phone at (xxx) xxx-xxxx; or Dr. Cindy Petersen, Advisor, at xxxxx@brandman.edu

e) My participation in this research study is voluntary. I may decide to not participate in the study and I can withdraw at any time. I can also decide not to answer particular questions during the interview if I so choose. I understand that I may refuse to participate or may withdraw from this study at any time without any negative consequences. Also, the Investigator may stop the study at any time.

f) 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 Vice Chancellor of Academic Affairs, Brandman University, at 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 and hereby consent to the procedure(s) set forth.

_____

Signature of Participant or Responsible Party

_____

Signature of Principal Investigator

_____

Date

Interview Protocol

"My name is Carliza Bataller, I serve middle school students and their families as an educator at American Canyon Middle School and look for ways to improve our practice to better prepare our students for success in their lives. I'm a doctoral candidate at Brandman University in Organizational Leadership. Briefly, I am conducting research to identify best practices of technology integration in middle schools. Additionally, I am researching the level of importance of those practices and possible barriers to technology integration.

I will be conducting approximately 5 - 6 interviews with middle school teachers identified as expert on technology integration. The information you provide, along with the information provided by others, hopefully will provide some insight into middle school technology integration.

Incidentally, even though it appears a bit awkward, I will be reading most of what I say. The reason for this is to guarantee, as much as possible, that my interviews with all participants will be conducted in the most similar manner possible.

Informed Consent (required for Dissertation Research)

I would like to remind you any information that is obtained in connection to this study will remain confidential. All the data will be reported without reference to any individual(s) or any institution(s). After I record and transcribe the data, I will send it to you via electronic mail so that you can check to make sure that I have accurately captured your thoughts and ideas.

You received the Interview Informed Consent and Brandman Bill of Rights in an email and responded with your approval to participate in the interview. The Informed Consent included a confirmation regarding the audio recording and confidentiality. Before we start, do you have any questions or need clarification about either document?

We have scheduled approximately 30 minutes for the interview. At any point during the interview you may ask that I skip a particular question or stop the interview altogether. For ease of our discussion and accuracy I will record our conversation as indicated in the Interview Informed Consent.

Do you have any questions before we begin? Okay, let's get started, and thanks so much for your time. The interview is a follow up to the survey instrument and will be used to delve deeper into the topics measured there. The three focus areas of the research are 1) best practices in middle school technology integration, 2) identifying most important best practices in middle school technology integration and 3) identifying barriers to middle school technology integration.

Background:

1. Please share with me your professional and educational background.

2. Describe briefly your school/district setting and demographics.

You have been identified as an expert in middle school technology integration by your principal or superintendent. (Note: a copy of the survey instrument is provided to you for voluntary reference in answering the following questions.)

3. The survey (question 4) results indicated that 70% of experts in middle school technology integration modeled all five components of digital citizenship. Can you provide some specific best practice examples of modeling digital citizenship?

4. Similarly, the results from question 5 of the survey reported that 69.3% of respondents use all five components as outlined. Can you provide some specific examples of how you use digital tools and resources as outlined in the survey?

5. Reviewing question 6, can you provide some specific examples of how you use technology interactively?

6. The use of digital learning environments which incorporate student achievement data and individual interest and learning styles was the topic of question 7. How do you specifically do this in your middle school classroom?

7. The ISTE Standards address the use of technology for research and problem solving (reference survey question 8). Can you provide some specific best practice examples of this?

8. According to the literature, early adolescents/middle school students have unique needs; how do you incorporate; positive social interaction, physical activity, creative expression, etc. (see list in question 10 of survey)?

9. The survey contained a section for teachers to rate the most important best practices (reference question 13 -20). As you review these, could you specify 3 – 5 of these that you would identify as the most important?

   •

10. The survey identified the top 5 barriers to middle school technology integration as

    Lack of technology resources (Hardware, Network, and/or Software, Inadequate funds to implement
    instructional technology, large class size, not enough time for learning and implementing new technology,
    Insufficient internet connectivity (Bandwidth)

a) Which of these do you see as most challenging?
b) Are there ways you or your school/district mitigate these challenges?

11. If there were one piece of advice you could give to middle school teachers who are struggling with technology integration – what would that be?

Thank you very much for your time. If you like, when the results of my research are known, I will send you a copy of our findings."

GENERIC PROBES THAT CAN BE ADDED TO ANY QUESTION TO PRODUCE MORE CONVERSATION:

1. *"Would you expand upon that a bit?"*
2. *"Do you have more to add?"*
3. *"What did you mean by …."*
4. *"Why do think that was the case?"*
5. *"Could you please tell me more about…. "*
6. *"Can you give me an example of …."*
7. "How did you feel about that?"

Suggest you put these generic probes on a card so you can use them any time you need to encourage an interviewee to say more about a question you have asked

APPENDIX E

Permission to Use Excerpts from Donna Petty

Walden Dissertation Instrument

Cindy.Petersen <Cindy.Petersen@gcccharters.org> Sun, Sep 10, 2017 at 9:54 AM
To: Carliza Bataller <bata8801@mail.brandman.edu>

Print and keep.
We need to reference this in Chapter 3 and on irb - I will review the best way to do this.
C

Sincerely,
Cindy Petersen, Ed.D.
Superintendent/CEO
Gateway Community Charters

Creating quality school choice in the greater Sacramento area since 2003.

Begin forwarded message:

From: Donna Petty <dpetty@richland2.org>
Date: September 10, 2017 at 9:34:40 AM PDT
To: "Cindy.Petersen" <Cindy.Petersen@gcccharters.org>
Subject: Re: Walden Dissertation Instrument

Certainly! Anything to help another doctoral student!

Blessings!
[Quoted text hidden]
--

Donna M. Petty, Ed.D.,
NBPTS - Early Adolescent Science
8th Grade Science Teacher
Science Department Co-Chair (IB)
E. L. Wright Middle School
(803)736-8740 ext. 3217
dpetty@richland2.org
https://sites.google.com/a/richland2.org/petty-s-8th-grade-class/