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INSTRUCTIONAL TECHNOLOGY IMPLEMENTATION: BARRIERS IMPACTING STUDENT SUCCESS

Roxanna Zendejas

INSTRUCTIONAL TECHNOLOGY IMPLEMENTATION:

BARRIERS IMPACTING STUDENT SUCCESS

A Dissertation

Presented to the

Faculty of

California State University,

San Bernardino

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Education

in

Educational Leadership

By

Roxanna A. Zendejas

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Approved by:

Dr. Sharon Brown-Welty, Committee Chair

Dr. Stephen Bronack, Committee Member

Dr. Daniel Martinez, Committee Member

ABSTRACT

Purpose. The purpose of this comparative case study is to explore the benefits of effective technology integration in the classroom, as well as the best teaching practices related to instructional technology. It was designed to identify (a) educator beliefs, (b) digital divide, as well as other barriers, and (c) best practices and instructional strategies.

Methodology. This qualitative comparative case study research design explored the best practices of 10 middle school teachers by using a semistructured interview protocol. A qualitative design was selected to focus on an individual, partnership, small group, and organization. Using comparative case study allowed the researcher to gain insight from fellow educators on their implementation of instructional technology.

Findings. The practices middle school teachers use as they implement instructional technology in the classroom include promoting student engagement through Google Workspace, YouTube, and providing and collecting student feedback. Educators believed implementing instructional technology allows for convenience of accessibility, frequent collaboration, district training, and the importance of a supportive administrator.

Conclusion. The middle school teachers seek to provide their students with a set of technological skills that prepares them to be successful in their future. The teachers' determination to make the content engaging and relatable with

instructional technology demonstrates their dedication to student academic achievement.

Recommendations. School district facilitators should assess the current trainings they provide their incoming and resident teachers regarding implementation of instructional technology. One focus should be on supporting teachers with a training on how to implement instructional technology and various platforms to establish effective communication with students by providing real-time feedback. Future research could focus on determining if student academic achievement is a result of their technological skill set. To add to the research, observation of participants' implementation of instructional technology would provide a greater understanding of its benefits and capabilities.

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DEDICATION

My dissertation is dedicated to my mom, Bettina Zendejas. Not a day goes by that I don't think of you and wish you were here. Thank you for instilling in me the value of never giving up. Thank you for being my guardian angel and continuing to guide me through life. I know you're always with me. I miss you, Mama, and I hope I am making you proud. This is for you. I love you.

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CHAPTER ONE

INTRODUCTION

Background of the Problem

Research examining effective implementation of instructional technology in education comes with discovering a variety of factors that need to be considered to make such instruction possible. The literature review for this study examined the problem regarding the lack of technology integration due to teachers' beliefs and lack of knowledge about technology integration, lack of access to technology, and lack of motivation to implement what they have learned through professional development (MacArthur & Malouf, 1991; Thornton, 2017; Burkholder, 2012). Educators also face external and internal barriers each day that hinder their implementation of instructional technology (McLoughlin et al., 2008).

Digital Divide

According to Farmer (2020), the student group most affected by the gap in access are considered to be minority and low-income. African-American and Hispanic children are far more impacted by the digital divide than other children, in that they do not have access to a home computer (Becker, 2000). While access in rural areas is limited, children who live in urban and suburban homes are also without service, due to it being cost prohibitive (Farmer, 2020). Poverty is unquestionably an underlying factor in the digital divide, as high costs discourage internet access (Tiene, 2002). Strong predictors if a child has access to a home computer, as well as the quality of access, include income, education, and ethnicity (Becker, 2000).

Becker (2000) noted schools hold a crucial role in making sure less-advantaged students are provided an equal opportunity to enriching experiences, including being exposed to computer technology. Teachers' integration of technology is either enhanced or limited due to the level of technology infrastructure within the school, as well as students' overall computer literacy skills (Han et al., 2019). Equity issues are developed when individuals are empowered and have access, while other individuals lack the opportunities included with having access (Magnus-Aryitey, 2020). Ensuring equal access to computer-based learning opportunities requires an emphasis on the development of children's intellectual competencies and technical skills, rather than the number of computers within a school (Becker, 2000). The Low-SES students who are not provided with the equal opportunity to create digital artifacts are less likely to have the technical skills needed to empower their own creations and digital activities (Hohlfeld et al., 2017). Bridging technical gaps does not only include an improvement to physical access to technology, but also in opportunities for individuals to equally participate in society (Mäkinen, 2006). Social position and capital may be increased due to an individual's skill set in technology (Rogers, 2016).

Teachers' Beliefs About Using Educational Technology

Technology is likely to be utilized to a greater degree by teachers who are more capable and have an appreciation towards its implementation, which in turn, could potentially impact students' learning significantly (Herbold, 2010). Educators become motivated to experiment with integrating technologies in their lessons once they observe the impact technology has on students' learning (Ottenbreit-Leftwich, 2007). Utilizing available resources and considering students' current needs and technological skills are

involved with high quality technology instruction (Han et al., 2019). Teachers' beliefs are shifted as they effectively integrate technology and begin practicing student-centered patterns of teaching and learning (Palak & Walls, 2009). Through guidance and facilitation, teachers need to provide students with opportunities of activity engagement that will allow them to personally apply their knowledge and skills (Hohlfeld et al., 2017).

The literature review for this study showed less credentialed and less experienced faculty were employed at Low-SES schools, where teachers' perceptions of their students' technology literacy did not reflect the reality of the population (Warschauer et al., 2004). It is critical for teachers to use Information and Communication Technologies (ICT) frequently and purposefully; however, there is more importance in how their students are using it at school (Hohlfeld et al., 2017). The greatest challenge schools face with integrating the Integrated Learning System (ILS) into the classroom is that the majority of teachers do not view it as an integral component, but rather as a supplement (Van Dusen & Worthen, 1995).

Instructional Technology Barriers to Implementation

It has become far more evident that teachers need to use technology to improve teaching practices and student learning (Bowman et al., 2022). Barriers that hinder implementation of instructional technology may be internal or external to teachers (Bowman et al., 2022). Perspectives on teaching with technology are a crucial factor when making the decision whether to adopt or reject technology (Gurmak & Hardaker, 2014). Furthermore, teachers often hesitate to seek new technology for their classroom if they have limited experience or training (Kormos, 2021). Teachers are empowered to enhance student learning through technologies and digital resources with the

environment of professional learning and innovation educational administrators promote (Thannimalai & Raman, 2018).

Professional Development

Although classroom settings have educational technologies available, few teachers have been trained in how to successfully integrate the tools into their teaching (Sang et al., 2010). Teachers' proficiency with computers determines the likelihood in which students are able to experience the powerful ways in which computers are used (Becker, 2000). Despite the fact that technology is considered to be an empowering educational tool, failed implementations and misused resources are results of unequal access to quality professional development (Tawfik et al., 2016). Teachers at high-poverty schools are less likely to receive technology-integration training than their counterparts (Herold, 2017). Educators and school administrators must be provided with high-quality professional development in how to use technological tools, as well as how to create lesson plans that integrate the use of instructional technology into the curriculum (Tiene, 2002; Martin et al., 2010; Magnus- Aryitey, 2020). It is difficult for administrators to make well judged decisions and understand how to implement technology with the ineffective technology professional development principals receive (Garcia et al., 2019).

Administrative Support

When principals work collaboratively with teachers to build a professional community, student learning can be greatly impacted through the use of technology (Garcia et al., 2019). Not only do technology leaders need to hold discussions with their staff regarding the use of effective technology, but staff also need to be empowered to

experiment with technology in their classrooms (Kotok & Kryst, 2017). A major influencer of technology integration on a school campus is the principal's leadership behavior; therefore, it is crucial they understand how the various types of technology and their capabilities may be integrated and aligned to meet their school vision (Garcia et al., 2019). For example, a principal does not need to be an expert on technology but does need to have a reasonable understanding of how various technologies enhance learning and are able to be implemented (Kotok & Kryst, 2017).

Purpose Statement

The purpose of this comparative case study is to explore the benefits of effective technology integration in the classroom, as well as the best teaching practices related to instructional technology. Current educational challenges regarding instructional technology implementation require further examination to address academic inequities, such as the digital divide; educator beliefs, and; barriers educators experience, both internally and externally (MacArthur & Malouf, 1991; Magnus-Aryitey, 2020; McKenzie, 2007; McLoughlin et al., 2008).

Instructional technology has the power to transform the lives of students by preparing them with a developed skill-set they can use beyond their schooling (Rogers, 2016). In order to become transformational, educators must examine their work through the lens of the learner (Hoffman & Vorhies, 2017).

Research Questions

The following questions are a guide for this study:

1. How do educators' beliefs about using instructional technology affect its implementation?

2. How do barriers such as SES and the digital divide affect educator implementation of instructional technology?
3. What best practices and instructional strategies do teachers use to promote academic achievement and engagement through implementation of instructional technology?

Significance of the Study

This study will benefit educators, administrators, and policymakers by providing them with current research that sheds light on the significance that all students need to acquire the appropriate technology skills to fulfill their academic needs. Educators may be able to better address the academic achievement gap by recognizing the technological barriers that prevent students from achieving success in a technology-driven world. Administrators may better understand the importance of building capacity to provide professional development opportunities, as well as providing their support. Lastly, policymakers may be able to establish appropriate programs, resources and supports that allow students of all ages to be academically successful.

Theoretical Framework

Connectivism learning theory is the process by which knowledge is distributed across a network of connections where learning is determined by the ability to establish and cross such networks (Downes, 2022). According to Downes (2022), “A connection exists between two entities when a change of state in one entity can cause or result in a change of state in the second entity” (p. 60). Learning is interpreted through two separate networks, such as the neural network (personal learning) and social network (social learning); however, they interact with one another through the process of

perception by means of communication or conversation (Downes, 2022). Learners make connections with content, learning communities, and other learners to create and construct knowledge through the use of digital and social media platforms (Gerard & Goldie, 2016). In connectivism, knowledge emerges from the connections formed during network activity, rather than the concept of transferring, making, or building knowledge (Gerard & Goldie, 2016). Nonetheless, learning would not only be assessed in terms of the knowledge an individual gains, but also through the learning process evaluation in which learners connect with others to collaborate and share the knowledge gained (Gerard & Goldie, 2016).

There are four principles which describe successful networks and that can adapt to changing circumstances.

Diversity

Downes (2022) noted the importance of diversity and change in society. Downes provided the example of how one would not be able to notice any change within a network if every member is the same. Downes posited that with the push for more sameness rather than less sameness, our society is becoming less resilient and less capable of responding to change. According to Siemens (2004), learning and knowledge occurs when there is a diversity of opinions. Furthermore, with sameness, it becomes more difficult for different points of view to be recognized by a society, which also affect large-scale changes (Downes, 2022).

Autonomy

While individuals connect and influence one another, they each make their own decisions (Downes, 2022). When a society requires coordination, it takes a longer time

to adapt to change; therefore, when individuals have more autonomy, the faster they will be able to respond to changing circumstances within their society (Downes. 2022).

Openness

Networks have the potential to grow by adding entities through an openness of membership, which allows for new experiences and concepts to be recognized (Downes, 2022). Openness is a physical property of networks, not just an attitude or approach (Downes, 2022). Contrarily, a ‘closed’ network can also be created as a default due to individuals not working well with others (Downes, 2022).

Interactivity

Interactivity is the process by which the “knowledge of the network is created by means of the interaction between entities, and not distributed from one entity to the next, where knowledge is created at the center and then sent out” (Downes, 2022, p.78). When individual entities work and interact together, knowledge is created through an interactive process and is greater as a whole than as any individual (Downes, 2022). Downes further posits an individual person is not as intelligent as compared to society as a whole.

Assumptions

As the researcher, who is also a minority woman and public elementary school educator, there are several assumptions relevant to this study. Being that I teach at a Title 1, Low-SES elementary school in a district where each student is 1:1 with a technology device, that is the minimum requirement I expect the schools in my study to possess.

Potentially Influential Factors

Honesty or Integrity of Participant Responses

As I plan to conduct interviews, I believe the participants in my study will truthfully answer the questions I will ask in my interview protocol. I envision they would appreciate one taking interest in them and their experiences with instructional technology in the classroom. However, I am also aware the participants may not answer the questions truthfully or wholeheartedly; therefore, their responses may be somewhat altered and not completely honest. Being that participation in the study will be voluntary, I understand the responses will be limited to what the participant is willing to share.

Accuracy of or Utility of Instruments

I assume that each of the educators have some experience with integrating instructional technology into their lessons. Furthermore, I predict that some teachers have had more experience with technology and implement it more regularly than others. During the interview process of the study, I anticipate hearing that some of the participants may not implement instructional technology as regularly as others due to their personal beliefs and external barriers, such as infrastructure, administrative support, and professional development.

Inclusion Criteria for Participants

I envision my participants to all be educators in the public school system, all of who have had a minimum of two years of teaching. I anticipate including both male and female educators, who all have a minimum of a Bachelor's Degree. The participants in this study will have either a single subject or multiple subject teaching credential. The

sacrifices each participant will have to make are to have an interview with the researcher and possibly have one of their lessons observed.

Participant Motivation for Participating

I assume some of the participants will be excited and willing to demonstrate how they implement instructional technology in their classroom. Further, they might be interested in discovering how their colleagues and educators at another site integrate technology into their lessons. I am hopeful that this study may act as motivation for some participants to implement technology more regularly than they currently do, or in ways they have not yet tried.

Delimitations

Research shows a significant difference in use of instructional technology between High - and Low-SES status schools (Hohlfeld et al., 2017). Further, there are ecological factors that need to be considered, such as the mindset and culture of not only the participants but the students as well. By focusing this study on middle schools that have earned awards related to technology, other schools that may have high implementation of instructional technology but have yet to earn an award, are not being acknowledged for their efforts. Another delimitation includes only seeking public middle schools located in Southern California, rather than also including private or charter middle schools. It is possible that nearby elementary or high schools could also have their own strengths, challenges, and factors that could add valuable input to the research. The final delimitation of the study are the participants, all of whom have their own personal beliefs, values, skillset, and knowledge they bring to the classroom in the way they implement instructional technology.

Definitions of Key Terms

Instructional Technology. “Mindful and purposeful integration of digital technology tools into the teaching and learning process” (Sullivan et al., 2018, p. 344).

Educational Technology. “The study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources” (Januszewski & Molenda, 2008, p. 1).

Information and Communication Technology (ICT). “Using digital technology, communication tools, and/or networks to access, manage, integrate, evaluate, and create information” (ICT Literacy Panel, 2007, p. 2).

Integrated Learning Systems (ILS). “These systems include courseware and management software and run on networked hardware” (Van Dusen & Worthen, 2002, p. 28).

Low-SES School. “Those where more than 75.0 percent of the students are eligible for free or reduced-price lunch (FRPL)” (NCES, 2018, para. 1).

Mid-High-SES School. “Those where 25.1 to 50.0 percent of the students are eligible for free or reduced-price lunch (FRPL)” (NCES, 2018, para. 1).

Summary

A variety of factors need to be considered for effective implementation of instructional technology in education. Various stakeholders within the education system have a role that holds them accountable in ensuring students are receiving the quality education they deserve and are entitled to. Through connectivism learning theory, learners distribute their knowledge across a network of connections and their learning is determined by their ability to establish and interact with such networks (Downes, 2022).

According to Downes (2022), diversity, autonomy, openness, and interactivity are the four principles to connectivism that lead to successful, adaptable networks. Nonetheless, there are potential influential factors that lead to assumptions and delimitations within the research study.

Chapter Two will present existing research literature on how the digital divide, teachers' beliefs about using educational technology, and instructional technology barriers implementation affect student success. This qualitative comparative case study seeks to explore and expose the difference in use of instructional technology by comparing two middle schools with high implementation, one in each a High- and Low-SES community. The study will connect the personal challenges the participants encounter when implementing instructional technology, as well as highlight their successes. The study will conclude with advice for educators on how to embrace technology as an educational tool within the four walls of their classroom.

CHAPTER TWO

LITERATURE REVIEW

Introduction

Technology plays a significant role in today's society, in students' everyday lives, and specifically in education. When a teacher implements technology in the classroom, students gain a sense of familiarity with not only the content of the lesson, but also the technology (Moratelli & DeJarnette, 2014). Recent research shows that in order to engage today's digital learners in the learning environment, teachers need to incorporate technology whenever possible in their instruction (Moratelli & DeJarnette, 2014). Teachers and students can use technology in the classroom as an educational tool to provide learning opportunities for diverse learners, as well as increase interest and motivation for learning (Moratelli & DeJarnette, 2014; Holland & Holland, 2014). A large part of student learning is student engagement; therefore, when students believe the learning experience was fun and enjoyable, they take ownership of their learning and are able to improve their reading comprehension and literacy skills (Moratelli & DeJarnette, 2014).

Statement of the Problem

Research examining the implementation of instructional technology in education has highlighted a variety of factors that need to be considered to make instruction using technology effective. This literature review examines the problem regarding the lack of technology integration due to teachers' beliefs and lack of knowledge about technology integration, lack of access to technology, and lack of motivation to implement what they

have learned through professional development (MacArthur & Malouf, 1991; Thornton, 2017; Burkholder, 2012).

Purpose Statement

The purpose of this current study is to explore the benefits of effective technology integration in the classroom. Current educational challenges regarding instructional technology implementation require further examination to address academic inequities, such as educator implementation; educator beliefs, and; educator professional development.

Digital Divide

Technology has the potential to be a benefit for all learners, but if not used inclusively, socioeconomically disadvantaged and culturally diverse learners may continue to be marginalized (Rogers, 2016). Education is strengthened by instructional technology for the following two reasons: a) lower-income societies are limited in their access to sophisticated technology and high-status educational institutions, and; b) the educational content (Moghaddam & Lebedeva, 2004). One way to minimize knowledge gaps at all levels is to integrate quality research-based instructional practices as new technologies are released (Holland & Holland, 2014). Learners are more likely to attend college and achieve careers when technology is integrated through meaningful applications (Holland & Holland, 2014).

The digital divide is not limited to access to technology, but also includes the inequalities of skill sets and how it is implemented (Rogers, 2016). The divide is described as individuals of unequal positions who lack the skills and opportunities to digital access (Makinen, 2006). Access to instructional technology not only accounts for

having a set of classroom computers or physical devices, but also having reliable internet connectivity (Magnus-Aryitey, 2020). Digital inequality is also determined based on the varying implications of one's use and ability to improve their political, financial, and social capital (Hargittai & Hsieh, 2013). Nonetheless, race, socioeconomic status, and language are factors associated with the digital divide (Light, 2001).

The following studies explored the various educational issues related to the digital divide. Hohlfeld et al. (2017) noted that information and communication technologies (ICT) have become a crucial component to current society and transformed the way language and information is expressed. They indicated without access to ICT, as well as the ability to be used efficiently and effectively, ICT literacy cannot be attained. Further, they stated many socioeconomic disparities exist due to lack of opportunities and resources, including digital inequality. The researchers noted digital divide is a bigger issue than the ability to access information and technology; it is a matter of how it is used and its purpose. Their study focused on the following levels of the digital divide in schools: 1) school infrastructure - access to hardware and software, 2) classroom - frequency and purpose of use for instruction, and 3) individual - student empowerment.

Hohlfeld et al. (2017) posed the following research questions:

1. How equitable is access to hardware and software within Florida public elementary, middle, and high schools across SES statuses (high vs. low)? (Level One).

2. How does SES (high vs. low) impact the frequency and purpose of use of technology by students and teachers within the classrooms of Florida public elementary, middle, and high schools? (Level Two).

Hohlfeld et al. (2017) conducted a longitudinal study over the span of seven school years to examine the implementation of technology within elementary, middle, and high schools across Florida's 67 school districts. Data was drawn from the Technology Resources Inventory (TRI), which is a survey the Florida Department of Education (FLDOE) conducted every year to gather information from principals and technology coordinators across the state about the integration of technology within their schools. The data was filtered through a series of five phases to account for all analyzed data.

The data analysis included a multilevel model of and an intraclass correlation coefficient (ICC) was computed to determine depending and notedness of the data. For Level One, the researchers added time variables (since this was in Institutional Study). For Level Two, SES all school types were used. For each research question the following models were used:

1. ICC- Intercept model
2. Growth Model
3. School Type and SES status Model
4. Fixed Model with time as the categorical variable (p.143).

The results of this study were separated into two the following levels: a) Level One digital divide - student access to hardware and software, b) Level Two digital divide - teacher use of software, and student use of software.

Level 1- School infrastructure-

Student Access to Hardware

The first research question was to determine the equity of access to hardware and software within Florida public elementary, middle, and high schools across SES statuses. The results demonstrated when middle schools were compared to elementary schools, there was a significant difference in access of modern desktop computer to student ratio. When comparing modern laptop computer to student ratio, there was a significant difference when comparing high school to middle school. The authors noted significant differences between High- and Low-SES status for elementary school in 2008, as well as for high school in 2008, 2009, and 2010.

Student Access to Software

In regards to access to software available to students, the results demonstrated a significant difference between elementary and middle schools, as well as a difference between high and middle schools. The researchers noted SES was a significant factor for elementary all years of the study, and for middle school the final two years of the study in 2013 and 2014.

Level 2- Classroom- Frequency and purpose of use for instruction

Teachers

The second research question was to determine how SES impacted the frequency and purpose of use of technology by students and teachers within the classrooms of Florida public elementary, middle, and high schools. For the percent of teachers who regularly use software for administrative purposes, teachers in elementary schools used software for administrative purposes more significantly than those of

middle and high schools. High- or low-SES school also did play a factor in the regularity of their use. When it came to comparing the percent of teachers who regularly use software for instructional practices, teachers at the middle and high schools used it more regularly than elementary school teachers. High- and low- SES status also played a role at all school level types.

Students

The Level Two results also demonstrate a gradual progression in frequency that students used student-directed software over the course of the study at all three types of schools. There was a significant difference in use between elementary and middle schools, as well as a difference between high schools and middle schools. High- and low-SES status was a significant factor for elementary schools all years; middle schools in 2010 and 2012; high schools in 2008, 2010 and 2011. There was a significant difference between elementary and middle schools in the frequency that students used computer-directed software. High- and low-SES status was a significant factor for elementary schools all years, and for middle schools in 2008.

The researchers recommended future research to focus on developing a valid and reliable measurement system that measures integration of information and communication technologies. Such a measurement system they indicated, should include consistent language with the state and national levels Departments of Education. Other data collection tools, including performance assessments, should also be used to examine the digital divide and measure digital literacy skills of students and teachers. Future research should also consider other factors, such as, a) geographic location, b) student attributes, and c) teacher attributes.

Table 1

Summary of Student Access and Use of Instructional Technology

Research Question		Variable/Factor	Significant Differences
Level 1- School Infrastructure			
Student Access	Hardware	Modern desktop computer to student ratio	Elementary vs. Middle Schools
		Modern laptop computer to student ratio	High vs. Middle Schools
	Software	Software available to students	Elementary vs. Middle Schools
			High vs. Middle Schools
Level 2- Classroom- Frequency and purpose of use for instruction			
Use	Teachers	Percent of teachers who regularly use software for administrative purposes	Elementary vs. Middle Schools
			High vs. Middle Schools
		Percent of teachers who regularly use software for instructional purposes	Elementary vs. Middle Schools
	Students	Frequency that students use student-directed software	Elementary vs. Middle Schools
		Frequency that students use computer-directed software	Elementary vs. Middle Schools
*Significant Differences determined by High- and low-SES statuses			

Gonzales et al. (2020) also conducted a study through the lens of inequalities related to access. Their study examined how inequalities in the ability to maintain access to technology characterize the digital divide. Students of color and students of lower socioeconomic status (SES) disproportionately experienced hardships. The less-privileged populations experienced an ongoing struggle to achieve digital equality. The digital divide is not only a concern of who has access to the internet, but rather *how* the internet and digital communication technologies are used.

Gonzales et al. (2020) posed the following research questions and hypothesis:

- Research Question 1 (RQ1): In a sample of U.S. university students, to what extent do some students still experience difficulties in achieving, sustaining, and

coping with disruptions in access?

- Hypothesis 1 (H1): SES, as measured by parent education and tuition assistance,

will be negatively associated with students' technology maintenance struggles.

- Research Question 2 (RQ2): How are various measures of technology maintenance associated with GPA and how do those patterns vary with students' SES?

Gonzales et al. study used a survey that included 748 participants, which included the following demographic measures: a) sex, b) primary racial/ethnic identity, and c) grade level. Socioeconomic status was measured by the following two indicators: 1) parent education, and 2) receipt of tuition assistance from parents. The researchers used the results from their initial demographic questionnaire to form the following three focus groups: high SES; low SES; and mixed SES.

The data analysis included information on three focus group discussions that lasted approximately two hours each, and were conducted using a semi-structured discussion guide. The researcher transcribed the audio-recorded focus group discussions, and analysis of the transcripts then took place. The data analysis process was open-ended and used focused coding where emergent themes and patterns in the data were identified. The researchers noted they were able to compare themes and patterns by SES using data matrices.

The researchers found that nearly every college student owned a laptop, or some sort of technology device, and such was attained in a variety of ways, and there was a wide variation in the quality of technology access, as well as disruptions in access experienced. The researchers discovered students of color and those with lower SES

were more responsible in achieving and sustaining access; however, they had a more difficult time coping with the disruptions. Students who had contract cell phone plans and more poorly functioning laptops had lower GPAs than students who did not have a contract cell phone plan. The researchers found student achievement may be negatively impacted due to technology maintenance struggles, which may explain SES disparities in GPA.

Gonzales et al. indicated representative data is needed on this topic, which can be achieved through field experiments by creating an awareness of the relationship between access and academic performance. In order to address these methodological gaps, additional qualitative data may be useful; specifically, a targeted exploration of disconnection in middle- and high-SES populations. These findings could provide insight as to which factors of disconnectivity and instability are universal, not socio-economically dependent.

Another study that explored the connections between access and equity was conducted by Magnus-Aryitey and Cherner (2020). The researchers posited it is crucial to first understand what is meant by the term ‘access’ before the connections between access and equity can be explored. The researchers contended that adequate attention is not given to the issues regarding access in educational technology (edtech), and further they noted it is possible the edtech being developed caused accelerate inequity, instead of creating innovation in learning. In this study, the researchers analyzed how software developers working in edtech companies and instructional technology administrators in school districts each understand the term ‘access’ in their own contexts.

Magnus-Aryitey and Cherner (2020) used the following research questions to guide the study:

1. How do instructional technology administrators and software developers understand the term access?
2. How does their understanding of access impact the design and selection of edtech tools?

The researchers conducted semi-structured interviews to compare how software developers who create educational technologies understand the term ‘access’ as compared to instructional technology administrators who work with edtech in schools. The researchers used semi-structured interviews so both groups of participants, software developers and instructional technology administrators, could be asked the same initial questions but also allowed the opportunity for individualized follow-up questions. The eight participants for this study were recruited using convenience sampling, as well as the researchers’ professional networks, including recommended colleagues who worked as a software developer or instructional technology administrator.

The participants’ interviews were conducted using a video-conferencing platform, and were each scheduled for 30 minutes, although some lasted up to 45 minutes. The interviews were audio recorded, but the researchers took notes on the participants’ body language. An interview protocol was used to ensure alignment between research questions and the interviews.

The data analysis included an open-coding technique to analyze the interviews. After the interviews were recorded and transcribed, the researchers each analyzed the

participants' own words, NVivo codes, and notated by hand any words, phrases, or terms the participants said during the interview that carried meaning. Sociologically constructed codes were then created by each researcher rereading the interview transcripts with the NVivo codes, while also adding their own thinking, ideas, and connections. After each researcher independently completed the two levels of coding, they discussed their analysis and identified four main themes in the data; two for each group of participants.

Through the interview process, the researchers identified four main themes regarding how access is understood by the participants. The themes identified were: enough; differentiation; cross-platform capabilities, and usability. The definition of the term 'access' varied between the two participant groups.

Enough

The first theme identified for instructional technology administrators was *enough.* The researchers noted the definition as "access is the physical possession of devices for student use and bandwidth to run devices reliably" (p. 845).

Differentiation

The second theme identified for instructional technology administrators was *differentiation.* The operationalized definition is "access is product modification that takes into account the cognitive and somatic abilities of different student populations" (p. 845).

Software Developers

Cross-platform capabilities

The third theme overall, but first theme identified for software developers was *cross-platform capabilities.* The operationalized definition is “access is software that looks and behaves the same on different devices and on different systems” (p. 845).

Usability

The fourth overall, but second theme identified for software developers was *usability*. The operationalized definition is “access is reflected in the front-end/user-interface/user experience design elements to support diverse users” (p. 845).

Magnus-Aryitey and Cherner (2020) recommended that edtech companies move toward creating mobile applications that can run on students’ cellular phones. The second recommendation was for edtech companies to build applications that work both online and offline. The last recommendation was for software developers to work directly with information technology administrators to create applications built around pedagogy.

Summary Digital Divide Research

The studies discussed above explored student access to technology hardware; however, one study was based on students’ personal devices and the others focused on school infrastructure (Hohlfeld et al., 2017; Gonzales et al., 2020; Magnus-Aryitey & Cherner, 2020). Hohlfeld et al. (2017) researched student access to software, as well as the frequency and purpose of use for instruction. Similar to Gonzales et al. study (2020), they found SES was a factor in achieving and maintaining access to devices, with lower SES experiencing a greater disparity, including GPA (Hohlfeld et al., 2017; Gonzales et

al., 2020). Magnus-Aryitey and Cherner (2020) further studied how instructional technology administrators and software developers have a difference in opinion of what the term ‘access’ means.

The three studies recommend future research include focusing on creating an awareness of the relationship between access and academic performance, as well as measuring digital literacy skills of students and teachers (Hohlfeld et al., 2017; Gonzales et al., 2020; Magnus-Aryitey & Cherner, 2020).

Teachers’ Beliefs About Using Educational Technology

It is vital for students in K-12 and beyond to develop skills in technology (Rogers, 2016). The importance of using digital resources to teach students through a variety of modalities is recognized by today’s English-language educators, more than ever before (Sartor, 2020). When teaching technology to diverse groups of learners, it is crucial educators consider and pay close attention to students’ needs, attitudes, and cultural perspectives (Rogers, 2016). Furthermore, before teachers use software in their classrooms, computers must be valued for compatible instructional goals (Becker, 2000). Nonetheless, important factors in determining how computers are used include teachers’ beliefs about computers and pedagogy (MacArthur & Malouf, 1991). The main reason educators struggle with change is due to lack of strategic planning in how to make such changes occur (Van Dusen & Worthen, 1995). Educators who have not had a substantial amount of experience or training with technology are often reluctant to implement it and may not recognize its potential benefits in the classroom (Herbold, 2010).

MacArthur and Malouf (1991) conducted research that explored new teacher beliefs about instruction that impacted their use of technology in the classroom. According to MacArthur and Malouf, teachers have many difficult issues when it comes to Computer-Based Instruction (CBI). The researchers noted the microcomputer is an educational tool that can be used in a variety of ways to reach various goals and further stated “the effectiveness of microcomputers in school settings depends on how they are integrated with educational goals and activities and with the organizational patterns of the schools” (p. 44). The researchers posited that research indicates computers are used ineffectively in special education, and they bring awareness to the concerns of appropriateness and limited range of computer activities that special education students are utilizing. The researchers noted that another concern is whether teachers are adequately monitoring student performance.

As a background to their study, the researchers described how a teacher has a significant role when it comes to microcomputers and determining if or how to use computers within their instruction and curricula. The researchers claimed teachers are required to make complex decisions when using microcomputers, such as:

a) creating goals and objectives

b) materials selection and activity planning

c) classroom organization

d) monitoring and reacting to student performance during instruction

e) performance and lesson evaluation for further planning (p. 45).

MacArthur and Malouf stated, “teachers’ beliefs about computers and about pedagogy are important factors in determining how computers are used” (p. 45). They

pointed out prior research showed that depending on teachers' overall educational goals and beliefs, computers were used in varying ways. For example, the researchers noted that computers were used entirely for drill-and-practice on reading, math, and spelling skills by teachers who focused strongly on basic skills; whereas another teacher, who supported developing social and problem-solving skills, had students use the computer to plan group projects.

Their research used the following questions to guide the study:

1. To what extent was computer use influenced by teachers' overall educational beliefs and goals, classroom organization, and instructional approaches?
2. In what ways was the computer-in-the-classroom a unique phenomenon, determined by teacher beliefs and knowledge about computers, the planning demands of a complex innovation, and characteristics of the machine and software?

In this study, five participants for this study were elementary school special education teachers, three of which had a self-contained class and two were resource teachers. To be selected to participate, participants were required to meet the following criteria: a) at least 2 years of experience using computers in a special education classroom, and b) throughout the study, teachers had to have full-time access to a microcomputer in their classes.

The researchers chose to conduct their study within a school district that was located in a large and relatively affluent metropolitan area that had made a significant commitment to microcomputers. The researchers noted the school district had a computer curriculum for all grades; however, the curriculum was not mandatory

because many of their schools did not have access to sufficient computers. The curriculum focused on the following computer units for grades 4-6: fourth grade focused on Logo, fifth grade focused on word processing, and sixth grade had a focus on use of databases in studying African countries. Teachers were offered mini-courses through the district, which focused on the three curriculum areas.

The study was a qualitative study and the data collected for this case study included classroom observations, as well as structured and informal teacher interviews. The researchers began conducting observations at the end of September and ended in December or January (sites making more extensive and varied use of computers had observations continue longer). After the researchers conducted the first few observations, they conducted semi structured interview with each teacher that lasted about an hour. The participants were asked a common set of questions about their overall educational goals, their beliefs about computers, and their plans for computer use. Near the end of the observations, the researchers conducted a second formal interview, involving individual questions for each participant to clarify points of confusion and react to preliminary conclusions. Both of the formal interviews were tape-recorded and transcribed. According to the researchers, informal interviews or discussions took place after completing the observations to answer questions that manifested during analysis, all of which occurred at the participants' convenience. The researchers collected a variety of documentary evidence, such as teacher plan books, instructional materials, record-keeping forms, district and school curricula and computer policies.

As their study progressed, MacArthur and Malouf and their research team developed new sets of questions as different computer applications were presented and

noticed they consisted of different planning issues; therefore, they created separate but parallel questions for word-processing and drill-and-practice applications to highlight similarities and differences.

The research team developed a coding scheme for the field notes based on the original questions, where each member coded their own and portions of other members' notes then discussed the coding that took place. According to MacArthur and Malouf (1991), "[c]oding and retrieval of field notes and transcribed interviews was greatly facilitated by the computer" (p.49). MacArthur and Malouf noted that all of the researchers wrote and discussed memos on some common issues, such as teacher goals for computer use at each site. The participants were asked to comment on tentative interpretations and questions during their final interview, where their reactions were also incorporated into the analysis. Findings from their research include the categories of beliefs, classroom organization, planning for application, word processing, and drill-and-practice.

Beliefs About and Goals for Computer Use

The researchers noted that the participants in the study were enthusiastic about the potential of computers in special education. According to MacArthur and Malouf, nearly all of the participants mentioned the positive effects of computers, such as "improving self-esteem, increasing motivation, compensating for disabilities, and fostering computer literacy" (p. 66). The researchers found that the participants' goals for computer use were consistent with their overall educational goals in several ways, and they all expressed an intent to integrate computer use with the rest of the curriculum. Further, the researchers noted the participants' beliefs about how the unique

potential of computers influenced how they were used in their classrooms, and how the participants' emphasis on improving students' self-esteem was paralleled in their own personal and professional motivation for using computers.

Classroom Organization

The researchers noted how important determinants of how computers were used relied on the participants' normal routines for organizing their classrooms. The researchers claimed that the participants attempted to fit computers into their organizational structures, managed computer use, and resolved management problems consistently with their overall classroom organization.

Planning for Specific Instructional Applications

According to MacArthur and Malouf, "[t]he predominant applications of computers were word processing and drill-and-practice, which were both used to some extent by all teachers" (p.68).

Word Processing

The researchers noted word processing as a major application all participants planned to use throughout the year; however, it varied from minimal, to weekly, to more extensive. The authors described how each participant had a different instructional emphasis in the way they used word processing.

Drill-and-Practice

MacArthur and Malouf noted that in most of the participants' classrooms, drill-and-practice on the computer was not well integrated with other instruction. The authors stated "[a]ll of the teachers used drill-and-practice software in one or more areas, most often math, spelling, and keyboarding" (MacArthur and Malouf, 1991, p.68). The

researchers noted in some of the classes, students often worked on inappropriate content because drill-and-practice computer activities were not carefully assigned and monitored. On the other hand, one of the participants did assign appropriate content for computerized spelling drill-and-practice, but the drill was inefficient and the software used was unrelated to the curriculum. The researchers explained how microcomputer-based drill-and-practice activities require teachers to adjust from their familiar routines of planning, monitoring, and evaluating instructional tasks and student performance.

MacArthur and Malouf recommended that teachers need to be actively involved in planning how they will use computers with their classes because they differ widely in their goals and educational approaches. The second recommendation as a result of the research was that teachers need greater support in the area of planning and monitoring of drill-and practice activities. The researchers noted that one way teachers can gain this support is by using integrated software that provides more comprehensive coverage of the material in a subject area. The third and final recommendation the researchers suggested is to provide teachers with training that focuses on instructional design and the specific ways that computers can support effective instruction.

Another study by Palak and Walls (2009) also explored teacher beliefs and how those beliefs impacted technology use. Palak and Walls (2009) noted that previous studies had been conducted to determine “whether schools’ technology investments and teachers’ increasing ability to use technology have played a major role in the way teachers use technology to improve student learning outcomes” (p. 417). The researchers posited teachers’ beliefs are shifted as they effectively integrate technology

and their instructional practices become student-centered. Their study examined the following:

a. Teachers' instructional technology practices in terms of teacher use and student use and

b. How this use related to teachers' beliefs (p. 419).

Palak and Walls used the following research questions to guide their study:

Quantitative Phase:

1. How do teachers' beliefs relate to their instructional technology practices?
2. How do factors other than beliefs relate to teachers' instructional technology practices?

Qualitative Phase:

1. Do teachers who work in technology schools and who are equipped to integrate technologies change their beliefs and consequently technology practices toward a student-centered paradigm?

The researchers conducted a case study using an explanatory mixed-methods design, which was "based on the empirical evidence in previous research on the relationship between teachers' educational beliefs and their instructional technology practices" (p. 419). The researchers noted they were interested in only sampling technology-using teachers in technology-rich schools; therefore, the 113 participants were PK-12 teachers from 28 Benedum Collaborative Professional Development Schools (PDS) in the northern part of West Virginia.

Palak and Walls used two surveys to collect quantitative data, with the first being the Inventory of Philosophies of Education instrument. The researchers noted they used

this survey to measure teachers' student-centered and teacher-centered beliefs. Palak and Walls (2009) also used the Perceptions of Computers and Technology instrument as a way for teachers to report their use of technology in the classroom.

For the qualitative phase of their research, Palak and Walls conducted a comparison of two case studies. The researchers "used the maximum variation sampling strategy to purposefully select two pairs of cases with extreme or maximal differences in teachers' beliefs based on teacher self-report to the Inventory of Philosophies of Education" (p. 421). Once the researchers identified the cases, they invited the four teachers to participate in the study and requested the following sources of data:

a. A classroom observation

b. An interview

c. A lesson plan

d. Their written reflections to four open-ended questions about their educational beliefs and practices (p. 421).

Classroom observations and interviews were scheduled for the same day; participants were asked to provide a lesson plan and written reflection the day of their interview, and; interviews took place in the teachers' classrooms and lasted 60-90 minutes. Palak and Walls "designed the interview questions to capture teacher beliefs, experiences, opinions, and values about education and technology use in the classroom" (p. 421). The researchers noted the multiple sources of qualitative data they collected provided a substantial description of why teachers integrate technology, as well as their minimal internal and external barriers in doing so.

For the data analysis of the quantitative data, the researchers used the following seven predictors for analysis:

a) Student-centered beliefs

b) Teacher-centered beliefs

c) Attitudes about technology

d) Teacher confidence and comfort with technology

e) Technical support

f) General school support

g) Ratio of computers to students in the classroom (p. 421).

Further, the researchers used the following three criterion variables to describe teachers' technology practices:

a) Teacher software use

b) Student software use

c) Instructional strategies (p. 421).

For the qualitative analysis, the researchers wanted to discover if teachers' beliefs and instructional technology practices moved toward a student-centered paradigm after receiving technology training and having technology available at their schools. The researchers triangulated all data sources using the variables in the quantitative phase, except the ratio of computers to students, where recurring themes were captured. Palak and Walls read, color coded, and merged lines when analyzing the interview transcripts. The remaining nine variables were collapsed into the following six categories:

a) Teacher beliefs about education

b) Teacher beliefs about curriculum

c) Teacher and student technology use

d) Teacher attitudes toward technology

e) Support for technology integration

f) Impact of technology integration on their practice (p. 422).

The results of their study were divided into quantitative and qualitative results sorted by research question.

Quantitative Results

Question 1: How Do Teachers' Beliefs Relate to Their Instructional Technology Practices?

Multiple regression and correlational analyses were conducted and the variables that emerged as significant include a) teacher software use, b) student software use, and c) the selection of instructional strategies. Further, researchers found that teacher attitudes toward technology was the most important belief factor related to their instructional technology decisions in the classroom.

Question 2: How Do Factors Other than Beliefs Relate to Teachers' Instructional Technology Practices?

In this study, only comfort and confidence were found to be significant for teacher software use. As a result, the researchers posited that teachers' use of certain types of software increased based on the technical and general school support. They also asserted the ratio of computers to students in the classroom made a greater impact on the instructional decisions and strategies teachers selected.

Qualitative Results

For the qualitative results, the two cases with teacher-centered beliefs found that having students interact one-on-one with computers constituted student-centered, independent learning. Both teachers in the study had their students use an integrated learning system (ILS) to repeat and reinforce skills until they were mastered. Palak and Walls (2009) noted that although the two teachers with student-centered beliefs reported using technology in a similar way as the teachers with teacher-centered beliefs, "their perception contrasted dramatically from the viewpoint of the two teachers with teacher-centered beliefs" (p. 435). The researchers noted that both teachers with student-centered beliefs acknowledged how technology supported a project-based approach to teaching, enable students to take ownership of their learning at their own pace, as well as support students with learning disabilities. According to the researchers, neither teacher used computers for mastery of skills, rather "[t]hey both emphasized process skills such as critical thinking and cooperative learning" (Palak & Walls, 2009, p. 435). Further, the researchers noted that while although all four teachers frequently used technology for planning, management, and communication, using technology did not change the way they taught or had students use technology in the classroom. The researchers also noted the teachers' educational beliefs primarily influenced the ways they had students use technology.

As a result of their study, the researchers recommended teacher training should move toward integrating technology into the curriculum to help teachers support student-centered pedagogy. The researchers also recommended professional development for teachers would help them with using instructional technology in their

contexts. Lastly, the researchers recommended that when studying instructional technology related to teacher use in the classroom, the study should include a mixed methods approach.

Summary Teachers' Beliefs About Using Educational Technology

The studies above described how implementation of technology in the classroom was used to improve students' self-esteem, as well as to reinforce skills until they were mastered (MacArthur & Malouf, 1991; Palak & Walls, 2009). The researchers found teacher attitudes towards technology as the most important belief factor for implementation (Palak & Walls, 2009). The researchers recommended providing teachers with support and training in integrating technology into the curriculum, as well as specific ways computers can support effective student-centered pedagogy instruction (MacArthur & Malouf, 1991; Palak & Walls, 2009).

Instructional Technology Barriers to Implementation

External barriers typically include unavailable resources, such as lack of equipment, time, or training (McLoughlin et al., 2008). However, barriers exist beyond supplying and supporting the infrastructure of computers (McKenzie, 2007). Internal barriers include an individual's roles, beliefs about teaching and technology, established teaching practices, and unwillingness to change (McLoughlin et.al, 2008). The implementation of instructional technologies in the classroom is also impacted by the support, decisions, and actions of an administrator (Herbold, 2010).

Lu and Overbaugh (2009) noted integration of instructional technology has not been consistent since computers began appearing in schools. The researchers noted that while hardware purchases within schools have improved over the years and teachers have attended professional development opportunities, technology is not often

integrated consistently as a tool for both, teaching and learning. Lu and Overbaugh (2009) stated “[r]esearch has been conducted to seek to explain why technology integration in schools has been disappointingly slow when the educational benefits of technology are evident and technology resources seem to be available” (p.90).

Lu and Overbaugh also pointed out various external and internal barriers contributing to the lack of instructional technology integration. For example, according to the researchers, the following are the most common external barriers: a) access to resources, b) time, c) technical support, and d) leadership. Internal barriers include teachers’ beliefs, ability, and attitudes towards integration of instructional technology. Using these variables, they undertook a study to explore the impact of these barriers on implementation at public schools.

Lu and Overbaugh used the following research questions to guide their study:

1. What are the most salient technology implementation barriers in K-12 public schools?
2. Do technology implementation barriers vary for urban, suburban, and rural public schools?
3. Do technology implementation barriers vary for public elementary, middle, and high schools?
4. What is the state of technology implementation in mid- and southeastern Virginia schools?

The participants for this study were K-12 in-service teachers who participated voluntarily in professional development targeting integration of technology in their classes. The researchers developed a four-section survey instrument to conduct with

their participants, which included: a) their knowledge of technology standards; b) how participants use new technologies; c) assesses how students use new technologies; and d) local support.

The researchers triangulated their quantitative data from the survey with semi-structured interviews with the participants. The survey was a comprehensive instrument that included both student learning and integration and use of technology in classrooms.

The researchers sent out an email to teachers who took part in instructional technology professional development and requested they complete the Technology Implementation Survey. Of those teachers, 177 participants responded to the survey and 10% were randomly selected for audio taped semi-structured interviews which lasted between 30 and 40 minutes. The researchers also allowed the participants to choose where the interview took place. The researchers noted most interviews were conducted in person; however, a few were conducted via telephone.

Data Analysis

The researchers used descriptive statistics to analyze the data from the survey. In addition, an analysis of variance (ANOVA) was conducted using the eight technology implementation factors as dependent variables, with school locations and school levels serving as independent variables. The researchers also used the interview transcripts "to identify what difficulties participants confronted when incorporating technology into their teaching practice" (p. 95).

For Research Question 1, the quantitative results showed the most serious problem with implementation was time constraints. Other significant findings included: a) technical problems that could not be taken care of in a timely manner; and b) access

to adequate and appropriate software. According to Lu and Overbaugh (2009), “the two areas that were perceived to be particularly satisfactory were administrative support and continual technology education opportunities, which indicated the general recognition of the importance of technology in education at the administrative level” (p. 96).

The quantitative findings for Research Question 2 showed significant differences on the following six dependent measures:

a) Easy access to hardware
b) Easy access to software
c) Easy access to technology integration professionals
d) Easy access to technical support staff
e) Timely solution to technical problems
f) Sufficient continual technology education opportunities (p. 96).

In addition, researchers found significant differences between rural and suburban schools on four of dependent measures: easy access to hardware, easy access to software, easy access to technical support staff, and timely solution to technical problems. There were also significant differences found between urban and suburban schools on the following three dependent measures: a) easy access to technology integration professionals, b) timely solution to technical problems, and c) sufficient continual technology education opportunities. The researchers found schools with the most favorable conditions in regards to implementation of technology were the ones located in suburban areas, rather than the schools located in urban and rural locations.

The quantitative findings for Research Question 3 showed there was no significant difference among the three types of schools, and they “were almost identical

in terms of hardware/software access, administrative support, and time constraints" (p. 97).

Related to the qualitative findings of their study, interviewees commented they had very supportive and encouraging administrators with learning and their use of technology in the classroom. Most of the participants expressed their interest in using technology, but mentioned that they needed more time to design a lesson integrating technology. The researchers also noted that teachers from rural schools reported having limited access to technology resources, which includes not having either hardware or software, or the devices were out of date. The biggest problem the interviewees mentioned was their frustration regarding technical problems, and how the issues are not resolved in a timely manner.

Lastly, Lu and Overbaugh noted that while the issues of time constraints, delayed resolutions of technical problems, and lack of properly functioning computers in rural schools are still ongoing, "continual efforts to address these problem at the local, state, and federal levels are likewise ongoing and have succeeded in moving forward the state of technology integration environment" (p. 100).

In addition to time constraints and technical problems as discussed above, the involvement of school administrators is crucial in all levels of planning and technology integration schoolwide, as they are responsible for new technology programs being implemented (Daniel & Nance, 2002). Instructional technology administrators take into account the budget, school infrastructure, teachers' and students' needs when making recommendations for the purchase of educational technology tools (Magnus-Aryitey, 2020). Information technology administrators are also working to provide the physical

tools, along with providing students with pedagogy, teachers with training, and the tools necessary to differentiate and meet educational goals.

According to Daniel and Nance (2002), administrators are now being held accountable for the success technology programs have within their schools, and play a role in developing curricular strategies in the information age; whereas, administrators were previously not required to have technology training. Nonetheless, it has become apparent that school administrators must now be trained in instructional technology to effectively support teachers and students in their daily academic lives.

According to Daniel and Nance, accreditation boards have prepared performance indicators in the area of technology, in an attempt to strengthen preparation standards for teachers and students. The researchers noted such standards call for the full integration of technology in school curricula, as well as the support from school administrators to be involved in all levels of planning to make such implementation possible in schools. Daniel and Nance further noted that all administrators are expected to comply with the governmental directives and implement such policies. The researchers contend administrators, particularly school principals, must follow and be held accountable to the guidelines created by the International Society for Technology in Education (ISTE), which include:

1) Creating and implementing a technology curricula

2) Ensuring that teachers and students have the opportunity to obtain skills in technology

3) Communicating to parents the opportunities available to students in this area

4) Creating a teacher-evaluation instrument that assesses teacher proficiency in integrating technology into the curriculum

5) Serving as the chief recruiter in attracting teachers with technological skills (p. 212).

According to Daniel and Nance, should administrative personnel fail to meet these responsibilities, they could be subject to charges of incompetency and insubordination, and may also face nonrenewal of contract or suspension.

Daniel and Nance comprehensively reviewed the literature to find national trends related to implementation of instructional technology, including administrative roles and implementation.

State Initiatives

Through their review, the researchers identified the following four general trends that have emerged from state statutes:

1. Nearly every single state made public school access to technology a priority
2. To support public school technology access, states have created state technology commissions, councils, offices, or departments
3. States have placed emphasis on teacher technology training
4. In an effort to guarantee teacher competence in technology, many states require teacher certification or licensure (p. 214).

Administrator Accountability

Daniel and Nance described the irony of what they did not see in the literature; how state lawmakers have not determined a role for administrators in education technology, especially since they are the ones who are ultimately held responsible for

the teaching and learning that occurs in schools. The researchers posited that legislators recognize that an important element of educating students for the 21st century is educational technology, and suggested administrators could be held accountable for not successfully integrating new communications media into the curriculum. The researchers then provided examples of cases where administrators were legally terminated for failing to uphold expectations in regards to curriculum and instruction.

Administrator Training and Policy Participation

According to Daniel and Nance, administrators now play a crucial role in creating curricular strategies and are being accountable for the success of technology programs in their schools, whereas they previously were not required to have technology training. The researchers contend the Collaborative for Technology Standards for School Administrators (TSSA Collaborative) is an effort to train school administrators in instructional technology so they can aid teachers and students to effectively use technology. In their review of the research literature, Daniel and Nance found the following six domains containing performance indicators:

1) Leadership and vision;

2) Learning and teaching;

3) Productivity and professional practice;

4) Support, management, and operations;

5) Assessment and evaluation; and

6) Social, legal, and ethical issues (p. 227).

The researchers posited that educators should be involved in developing effective policies since they are the ones at the forefront, and administrators could provide crucial feedback to legislatures.

Enlarging the Vision and Expanding the Technology-Related Education of Administrators

The researchers noted there must be a change in the way administrators are educated so they can be involved in shaping educational policies pertaining to instructional technology. Daniel and Nance stated, “[t]raining programs for administrators, particularly in instructional technology, should examine long-term consequences of decision-making” (p. 230).

As a result of their review, Daniel and Nance recommended that school administrators should be involved at all levels of the policy-making process, since they are the ones who are ultimately responsible for technology implemented within their school site. The researchers also recommended professional preparation programs for administrators to develop the perspectives and skills necessary for such change to be done accurately and efficiently, as well as to reduce administrative turnover.

Summary Instructional Technology Barriers to Implementation

Lu and Overbaugh (2009) posited the most serious problem to be time constraints for planning. The researchers also noted technical issues not resolved in a timely manner, as well as limited access to technology in rural schools (Lu & Overbaugh, 2009). Whereas, Daniel and Nance (2002) noted the importance of school administrators’ involvement in the implementation process of instructional technology. Nonetheless, both studies described continuous and proper training as crucial

components in instructional technology being implemented effectively in the classroom (Lu & Overbaugh, 2009; Daniel & Nance, 2002).

Summary

This literature review explored how the digital divide, teachers' beliefs about using educational technology, and instructional technology barriers to implementation affect student success. The researchers noted that instructional technology has the potential to benefit all learners when used inclusively among diverse learners by integrating quality research-based instructional practices (Rogers, 2016; Holland & Holland, 2014). Not only does the digital divide include access to technology, but it also includes the way it is implemented and the inequalities of skill sets (Rogers, 2016). However, race, socioeconomic status, and language are also factors associated with the digital divide, such as achieving and maintaining access to devices (Light, 2001; Hohlfeld et al., 2017).

Researchers noted teachers' beliefs about using educational technology and pedagogy are important factors in determining how computers are used (MacArthur & Malouf, 1991). Educators who are often reluctant to implement instructional technology in the classroom are ones who have minimal experience or training with technology, and may not recognize its potential benefits (Herbold, 2010). Nonetheless, computers are used in various ways depending on teachers' overall educational goals and beliefs; such as, drill-and-practice, developing social and problem-solving skills, or to plan group projects (MacArthur & Malouf, 1991).

According to the researchers, instructional technology barriers to implementation include both external and internal barriers. External barriers include lack of equipment,

unavailable resources, time, or training; whereas internal barriers include beliefs about teaching and technology, individual's roles, and unwillingness to change (McLoughlin et al., 2008). Researchers also noted the importance of school administrators' support, as well as their involvement in the implementation process of instructional technology (Daniel & Nance, 2002).

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

Research Design

The researcher conducted a comparative case study through qualitative design. Since individual participant interviews were conducted to gain insight from fellow educators on their implementation of instructional technology, a comparative case study best suited the methodology for this research study. Being that teachers are a major element of instructional technology implementation, the task was to identify if the digital divide, beliefs, professional development, and administrative support are, in fact, variables that need to be considered for successful implementation of instructional technology. Through the interview process, the participants were allowed the opportunity to answer questions in regards to their integration of instructional technology.

A case study research design was chosen to focus on an individual, partnership, small group, or organization (Creswell & Poth, 2018). This research methodology is a qualitative approach in which the researcher explored a real-life case, or multiple cases, over time by collecting in-depth data through a variety of information sources (Creswell & Poth, 2018). In this collective case study, multiple cases were selected by the researcher to demonstrate varying perspectives on the issue (Creswell & Poth, 2018).

Research Setting

This comparative case study took place at two middle schools, both within a school district located in Southern California. The researcher used the pseudonyms Eastwood

Middle School, Westhill Charter Middle School, and New Haven Unified School District. This research study explored and compared the implementation of instructional technology at Eastwood Middle School, a Low-SES school, and Westhill Charter Middle School, a Mid-High-SES school. New Haven Unified School District has two early childhood education schools, twenty elementary schools, eight middle schools, seven high schools, and one community education center. The district's student enrollment includes 74.6% Hispanic or Latino, 17.1% White, 2% Asian, 1.5% Black or African American, and 4.8% other. Approximately 77% of the student population are socioeconomically disadvantaged.

Eastwood Middle School is a small middle school within New Haven Unified School District that serves approximately 600 students in sixth to eighth grade. The student population of Eastwood Middle School is comprised of 1.2% African American, 0.5% American Indian, 0.5% Asian, 0.2% Filipino, 93.2% Hispanic, 2.5% White, and 0.5% Two or More Races. The socioeconomically disadvantaged student population is 99.1%, as well as a Foster Youth population of 1.4%, Homeless population of 2.1%, and Free or Reduced-Price Lunch population of 98.9%.

Eastwood Middle School is located in Indio, California, 33 square miles in size with an estimated population of 94,000. The ethnic composition includes 64.9% Hispanic, 27.9% White, 3.5% African American, 2.2% Asian, 1.4% Other, and 0.1% American Indian. Hispanic roots are evident throughout the community and are exhibited at locations such as restaurants, businesses, and places of worship (Martinez, 2019).

Eastwood Middle School has been recognized as an AVID Site of Distinction (Advancement Via Individual Determination), in its effort to prepare students to be college and career ready. While a variety of elective opportunities are provided to students, Eastwood Middle School has struggled to demonstrate academic success in mandated state testing for both English Language Arts and Mathematics from 2017-2019. The school mission is to instill positive social skills in students by learning resilience, academic endurance, and innovative thinking.

Westhill Charter Middle School is a large middle school within New Haven Unified School District that serves approximately 1,400 students in sixth to eighth grade. Westhill Charter Middle School serves a population of students comprising 1.6% African American, 0.1% American Indian, 5.4% Asian, 2% Filipino, 48.8% Hispanic, 0.1% Pacific Islander, 37.6% White, and 3.9% Two or More Races. The school has a socioeconomically disadvantaged student population of 47.3%, Foster Youth population of 0.1%, Homeless population of 1.8%, and Free or Reduced-Price Lunch population of 46.1%.

Westhill Charter Middle School is located in Palm Desert, California, a small city 27 square miles in size with an estimated population of 53,000, located about 11 miles west of Eastwood Middle School. The ethnic breakdown of the residents is 66% White, 24% Hispanic, 5% Asian, 3% African American, and 2% Two or More Races. The established culture within the community is a reflection of their golf courses, country clubs, resorts, and designer boutiques.

Westhill Charter Middle School is highly praised throughout the community for their steady trend of student academic success. Along with other recognitions, they have established the status of being a Gold Ribbon School by the California Department of Education. Their school mission is to provide their students with an environment where academic excellence, environmental stewardship, and social accountability as global citizens is attainable.

Research Sample

The researcher implemented the use of purposeful, maximum variation, and snowball sampling of individuals located at the two school sites that are being compared. A purposeful sample “intentionally samples a group of people that can best inform the researcher about the research problem under examination” (Creswell & Poth, 2018). The purposeful sampling technique that was used for this study is maximum variation sampling. Maximum variation sampling is a qualitative strategy in which the researcher determines differentiating site or participant criteria in advance (Creswell & Poth, 2018). This type of sampling in qualitative inquiry documents diverse variations of individuals or sites based on specific characteristics (Creswell & Poth, 2018). Snowball sampling was utilized as the initial participants from each school site were asked to identify other potential participants (Creswell & Poth, 2018).

Participants in this research study were fully credentialed teachers who work at Eastwood Middle School or Westhill Charter Middle School. The sample size was 10 teachers of various races, ages, classes, and genders, with 5 from each school site. The participants had varying years of teaching experience, but all have taught for a minimum of two years.

Research Data

The researcher developed an interview protocol with semi-structured questions to gather responses from a total of 10 participants. Five of the participants were teachers from Eastwood Middle School, and five participants were teachers from Westhill Charter Middle School. The participants taught either sixth, seventh, or eighth grade. Rather than focusing on specific grade levels, the researcher included teachers from varying content areas, such as English Language Arts, Mathematics, and Science or Social Science. The researcher also included one participant from each school site who teaches a technology course, such as STEM, Broadcasting, Coding, or Robotics.

Interview responses were gathered through the use of one-on-one interviews with the participants to provide them the opportunity to share their perspectives regarding the research questions that will be asked. Interviews were conducted in-person. There was a need to interview because each teacher has varying levels of professional development, beliefs, support, and barriers with implementing instructional technology in their classroom.

Research and Interview Questions

The following questions were explored in this study:

1. How do educators' beliefs about using instructional technology affect its implementation?
    a) What are the positive effects you find with implementing instructional technology?
    b) How do your beliefs and perspectives about using educational technology impact the way you integrate its use?

c) What kind of support and training have you received with integrating technology into the curriculum and how often do you seek such training?

d) What opportunities do you have to collaborate with other teachers at your school site? What are the results of those discussions?

2) How do barriers such as SES and the digital divide affect educator implementation of instructional technology?

a) How do you define ‘access’ to technology? How does your students’ ‘access’ to technology at home affect the way it is integrated into the homework you assign?

b) What types of barriers do you encounter with implementing instructional technology in the classroom?

c) What is your experience with technical issues being resolved in a timely manner? How often are the technology devices within your classroom maintained?

d) How does an administrator’s involvement and support impact the way instructional technology is implemented in the classroom and schoolwide?

3) What best practices and instructional strategies do teachers use to promote academic achievement and engagement through implementation of instructional technology?

a) Which software programs do you utilize and integrate most regularly into your lessons to promote engagement? What types of assignments do you have students complete using these software programs?

b) What type of assessments do you use to determine whether your best practices and instructional strategies implementing instructional technology positively impacted your students?
c) Identify best practices of instructional technology to build positive relationships with your students.
d) What instructional strategies do you use to improve academic achievement levels using educational technology?

Data Collection

The data for this study were collected using semistructured interview questions that informed the research questions. Follow-up questions were posed to provide clarification. Each of the 10 participant interviews were audio recorded with a tape recorder. After conducting each interview, the audio recording was uploaded to temi.com for transcription. Recording and transcribing each interview allowed the researcher to go back through each discussion, reread, and visualize participants' responses to determine common themes. To ensure confidentiality and protect the identity of each participant, they were assigned an identifier. The participants were provided the opportunity to verify their initial interview responses to provide an accurate recording of data for further analysis.

Data Analysis

At the completion of each interview, the recording was uploaded to a computer software for transcription. As each interview was collected, data provided by the participants was compared through content analysis of the five participants' responses from each school site, identifying common themes. A within-case analysis first

described each case and themes within the case before a cross-case analysis was “followed by a thematic analysis across the case” (Creswell & Poth, 2018). For this qualitative study, the researcher took all of the data they have collected and went through the reduction process by minimizing and simplifying it, making it more manageable to create categories and themes. The researcher then interpreted the data by explaining those categories and themes discovered from the data collection.

Validity, Trustworthiness, and Reliability

When collecting data, the researcher gathered information, as is, from the participant and did not let any biases affect the reduction and interpretation processes. As the study was conducted, the researcher ensured that the analysis, interpretations and conclusions were truthful, credible, plausible and believable. The researcher guaranteed the research was consistent and dependable.

Prior to conducting interviews with the participants, the researcher implemented the use of pilot testing of reliability to refine the interview protocol and procedures (Creswell & Poth, 2018). For the pilot study, the researcher selected a faculty member who was not included in this study, but who also has experience with implementing instructional technology in the classroom. This process allowed the researcher to make sure the questions being asked led to the responses and information hoped to be received from those questions. After participant interviews were conducted, the researcher conducted member checks in a follow-up email.

Positionality of the Researcher

One bias the researcher had towards the research study is that the participants at Westhill Charter Middle School have had greater success with implementing

instructional technology into their classroom, in comparison to Eastwood Middle School. The researcher maintained an open mind when interviewing the participants from both middle schools. The researcher only analyzed the data presented by the participants during the one-on-one interviews.

Summary

This chapter featured the methodology used in the comparative case study. The research study was conducted at two middle schools in Southern California, both within the same school district. Westhill Charter Middle School is known for their successful implementation of instructional technology and high academic achievement, who also serves a Mid-High SES student population. Eastwood Middle School, a Low-SES school, also offers integration of instructional technology but struggles to demonstrate academic success in mandated state testing.

The purposeful sampling technique the researcher used for this study was maximum variation sampling. The number of participants, along with the participant criteria, were also addressed in this chapter. An interview protocol that consisted of semi-structured questions was developed to conduct one-on-one interviews with each of the 10 participants. The researcher also addressed how the data was collected and analyzed, presented within the study, along with how the study was held reliable.

Chapter Four presents the results from the comparative case study that was conducted.

CHAPTER FOUR

FINDINGS

Introduction

This chapter provides the data and the analysis of the data used to explore best practices, instructional strategies, and barriers middle school teachers encounter with implementing instructional technology in the classroom. The chapter begins with an overview of the purpose of the study and the research questions. The data collection and data analysis are described and organized by research question.

Purpose Statement and Research Questions

The purpose of this comparative case study is to explore the benefits of effective technology integration in the classroom, as well as the best teaching practices related to instructional technology. The following questions are a guide for this study:

1. How do educators' beliefs about using instructional technology affect its implementation?
2. How do barriers such as SES and the digital divide affect educator implementation of instructional technology?
3. What best practices and instructional strategies do teachers use to promote academic achievement and engagement through implementation of instructional technology?

Participants

The 10 participants in this study were middle school teachers in Grades 6-8 from a large school district in Southern California. They were teachers who hold a single subject credential and have experience working with socioeconomically disadvantaged

students. Snowball sampling was utilized as the initial participants from each school site were asked to identify other potential participants (Creswell & Poth, 2018). This study's participants were current teachers in two middle schools in a Southern California unified school district.

The recommended participants for this study were both, males and females, who were able to provide insight into their experiences as middle school teachers. The participants had experience working in a general education learning environment across various content areas in either 6th-8th grade, which allowed for a comprehensive analysis of responses.

Participant Overview

Ten middle school teachers were selected to participate in this study. Table 2 provides a summary of the middle school teacher participants' attributes.

Table 2

Participant Characteristics

Participant	Valid Teaching Credential	Education Degree
P1	Yes	Bachelor's
P2	Yes	Bachelor's
P3	Yes	Bachelor's
P4	Yes	Bachelor's
P5	Yes	Bachelor's
P6	Yes	Bachelor's
P7	Yes	Bachelor's
P8	Yes	Bachelor's

Participant	Valid Teaching Credential	Education Degree
P9	Yes	Bachelor's
P10	Yes	Bachelor's

Data Collection

After receiving approval from the California State University, San Bernardino Institutional Review Board (IRB), the data were gathered from middle school teachers of one unified school district in Southern California. This study contributes to prior research to support the implementation of instructional technology and the barriers impacting student success.

The researcher created the semistructured interview protocol based on similar studies found in the Literature Review in Chapter 2, which supported and informed the research questions. The interview questions were reviewed by the research committee prior to the completion of the interview protocol. To ensure confidentiality and protect the identity of each participant, they were assigned an identifier. Participants were provided the opportunity to review, change, and elaborate on their initial responses. This review process was explained to each participant at the conclusion of the interview. The interview protocol used in this study can be referred to in Appendix 1. In summary, the interviews of middle school teachers who voluntarily participated were conducted using the following steps:

1. The researcher recruited participants by presenting this study to the teachers at both school sites, each during a staff meeting.

2. After each staff presentation, participants volunteered to participate in the study by emailing the researcher.
3. The researcher contacted each participant and scheduled a time and place to meet.
4. The researcher returned their interview responses to the participants for review and additional comments.
5. The researcher analyzed the participants' responses.
6. To establish privacy, alphanumeric identifiers were assigned to each participant.

Data Analysis

The interview responses were verified by the participants to support an accurate recording in this exploratory sequential design and analysis (Creswell & Guetterman, 2019). Participant responses were reduced into segments by following a qualitative approach that determined themes, patterns, and categories (Creswell & Guetterman, 2019) to describe best practices, instructional strategies, and barriers middle school teachers encounter with implementing instructional technology in the classroom. A coding system was developed after the researcher reviewed the data. The researcher read the participants' interview transcripts multiple times to understand their comments, noted potential themes, as well as how many times similar words were repeated. The theoretical framework and the learning theory of connectivism emerged through the coding (Roberts & Hyatt, 2019).

Validity and Reliability

Validity is a crucial component of a research study when a test or measure is conducted. In qualitative research, validity is oftentimes referred to as credibility and is

the degree to which the research findings reflect what was intended to be measured (Roberts & Hyatt, 2019). The validity of the interview protocol may be impacted by the length and complexity of the question structure. Reliability is otherwise known as dependability, which demonstrates support for the conclusions, or the instrument is consistent in measuring something (Roberts & Hyatt, 2019). Reliability can change based on an individual's attitude, health, and motivation to complete the interview (Martinez, 2019). A pilot test was conducted and a panel of three experts reviewed the self-designed interview protocol to alleviate threats to validity and reliability (Creswell & Poth, 2018).

Interview transcripts were reviewed by the researcher to gain a deeper understanding and perspective of each school's best practices of instructional technology implementation. Interview results were analyzed, coded, and organized into themes to allow for interpretation of findings (Creswell & Poth, 2018). To verify data collected, the researcher implemented the use of member checking during the study (Creswell & Guetterman, 2019). Participants in the study were asked to check the accuracy of data provided (Creswell & Guetterman, 2019).

Research Findings

The following findings from the research study are presented by Research Question and described by interview question. The tables are organized by the following sections: participant responses from School 1, participant responses from School 2, and the Major Themes across both schools.

Research Question 1

Research Question 1: How do educators' beliefs about using instructional technology affect its implementation?

The researcher analyzed the following survey questions to respond to research question 1: What are the positive effects you find with implementing instructional technology? How do your beliefs and perspectives about using educational technology impact the way you integrate its use? What kind of support and training have you received with integrating technology into the curriculum and how often do you seek such training? What opportunities do you have to collaborate with other teachers at your school site? What are the results of those discussions? Tables 3-6 provide a summary of the middle school teacher participants' themes and responses to Research Question 1.

Teachers were asked to reflect on the positive effects of implementing instructional technology in their classrooms. The responses from the participants of both schools are shown below in Table 3.

Table 3

Interview Question 1: What are the positive effects you find with implementing instructional technology? (Two or More Responses)

Response	Total Responses	% to Total Responses
School 1		
Organization of Student Assignments	4	28.6%
Promotes Student Engagement	3	21.4%
Convenience of Accessibility	3	21.4%
Supports Student Learning	2	14.3%
Allows Students to Relate to Content	2	14.3%
Total	14	100%
School 2		
Allows for Real Time Feedback	3	18.75%
Allows Content to be Visually Attractive	3	18.75%
Promotes Student Engagement	2	12.5%

Response	Total Responses	% to Total Responses
School 2		
Convenience of Accessibility	2	12.5%
Bridges Gaps w/ Personalized Instruction	2	12.5%
Access to Google Suite	2	12.5%
Provides Opportunity for Real-World Simulations	2	12.5%
Total	16	100%
Major Themes		
1a. Promotes Student Engagement		21.4% and 12.5%
1b. Convenience of Accessibility		21.4% and 12.5%

Table 3 demonstrates that participating teachers believe that promoting student engagement (33.9% of the responses) and the convenience of accessibility (33.9% of the responses) are the most positive effects of implementing technology in their classrooms from both schools. The next most popular response came from School 1 participants indicating that technology assisted in the organization of student assignments. The next highest response rate came from School 2 where participants indicated allowing for real time feedback (18.75% of the responses) and allows content to be visually attractive (18.75% of the responses) as a result of using technology in the classroom.

Theme 1a. Promotes Student Engagement. This theme emerged from the responses of five of the ten participants (50%). The following excerpts from the interviews support the theme:

> One of the positive effects I think would be student engagement. I think they're so used to doing things digitally now that when you don't, which is kind of like ‘What is it? Paper and pencil?’ So I definitely think it affects engagement and something new, exciting, flashy, and in their face when using instructional technology. I don't think that it affects comprehension or the outcome as much. Generally, I think that's much more dependent on the particular exercise that you're doing or the activity that you're doing. But I definitely do think that engagement is affected by instructional technology. (Participant 3, personal communication, November 14, 2022)

> I just think the different, like variations and everything, there's a lot of different things that help them stay engaged to it. All of the different animations and gameplay, and all these different things are more entertaining to them than just doing a worksheet. I teach math and a lot of it, I feel like I'm kind of old school in the sense that I'm like a paper-and-pencil kind of person. So all these instructional technologies kind of get away from that, which is probably better for kids nowadays if it's not so paper and pencil. It's a lot more animated, a lot more interactive, and has a lot more engagement going on. (Participant 4, personal communication, November 14, 2022)

> The students end up being more open to it. I think more you know, curious about 'what is this new technology that I've never seen?' Therefore, they want to play with it. They want to use it. Then, now that they're engaged, it makes it just a tad easier to instruct as they are engaged. (Participant 6, personal communication, January 11, 2023)

> I would say any classroom today that is going to be relevant to where our students are, and the needs of our students have to incorporate technology. I see that when students are using it, it engages them in a way that they're comfortable with now. I see that when they use it, they are able to access support systems or support add-ons using different platforms that really support their learning. (Participant 8, personal communication, January 18, 2023)

Theme 1b. Convenience of Accessibility. This theme emerged from the responses of five of the ten participants (50%). The following excerpts from the interviews support the theme:

> One is access to different types of curriculum and instruction. There are so many different resources out there now, whether it's instructional, assessment-based, just videos, or different ways to take notes. There are just a lot of resources out there. So as far as finding things that are more effective for instruction, there are a lot of different ways and there are just so many different variations of the same type of material so that each student can get more personalized instruction, more instruction that kind of caters to what they need. It's just way more easily accessible for them. (Participant 4, personal communication, November 14, 2022)

> The stress of not finding things, I think has gone away for a majority of kids because it's available, it's accessible to them, and it's accessible at home, which I think is really good too. They're not limited to just things on campus anymore. They can access this on their phones, they can access it when they're at home if they have internet. (Participant 8, personal communication, January 18, 2023)

Teachers were asked to reflect on how their beliefs and perspectives about using educational technology impact the way they integrate its use in their classrooms. The responses from the participants of both schools are shown below in Table 4.

Table 4

Interview Question 2: How do your beliefs and perspectives about using educational technology impact the way you integrate its use? (Two or More Responses)

Response	Total Responses	% to Total Responses
School 1		
Used in Moderation	3	33.3%
Minimalistic Teaching Style	2	22.2%
Awareness of Potential Benefits	2	22.2%
Enhancement Tool for Student Learning	2	22.2%
Total	9	99.9%*
School 2		
Prefers Paper, Pencil & Hard Copies of Textbooks	2	33.3%
Used in Moderation	2	33.3%
Response	Total Responses	% to Total Responses
School 2		
Have a Growth-Mindset Towards Technology	2	33.3%
Total	6	99.9%*
Major Theme		
1c. Used in Moderation		33.3% and 33.3%

*Did not add to 100% due to rounding

Table 4 demonstrates that participating teachers use instructional technology in moderation (66.6% of the responses) is the most popular belief about integrating technology in their classrooms from both schools. The next highest response rates came from School 2 participants indicating that they prefer paper, pencil, and hard copies of textbooks (33.3% of the responses) and have a growth mindset towards technology (33.3% of the responses).

Theme 1c. Used in Moderation. This theme emerged from the responses of five of the ten participants (50%). The following excerpts from the interviews support the theme:

> Sometimes I try to find ways to get them off Chromebooks. We still do a lot of old school note taking where we take notes in a binder like pen and paper and that kind of thing. So I think that, not that I'm anti the technology, but just the idea of not having them look at a computer monitor like every second of every day. I do try to find ways to steer away from it if possible. So I guess it doesn't necessarily impact the way that I integrate, just the amount of technology that I use on a daily basis. (Participant 4, personal communication, November 14, 2022)

> My belief on technology is that just like everything else, moderation and all things, you can't have everything on technology. You have to, you have to be able to balance it out. (Participant 7, personal communication, January 11, 2023)

Teachers were asked to reflect on the support and training they have received with integrating technology into the curriculum, as well as how often they seek such training. The responses from the participants of both schools are shown below in Table 5.

Table 5
Interview Question 3: What kind of support and training have you received with integrating technology into the curriculum and how often do you seek such training? (Two or More Responses)

Response	Total Responses	% to Total Responses
	School 1	
Received District Training	3	42.8%
Google Suite Training	2	28.6%
Self-Taught	2	28.6%
Total	7	100%
	School 2	
Seek Training Regularly	3	60.0%
Received District Training	2	40.0%
Total	5	100%
	Major Theme	
1d. Received District Training		42.8% and 40.0%

Table 5 demonstrates that participating teachers have received district training (82.8% of the responses) is the most support they have had with integrating technology into the curriculum. The next most popular response came from School 2 participants indicating that seek training regularly (60.0% of the responses). The next highest response rates came from School 1 where participants indicated they have received Google Suite training (28.6% of the responses) and they taught themselves how to use certain software platforms and curriculum integration (28.6% of the responses).

Theme 1d. District Training. This theme emerged from the responses of five of the ten participants (50%). The following excerpts from the interviews support the theme:

> The district does offer self-paced training in technology. So I use that because it's fun and gamified, so you get little badges and stuff. I've done that sort of when I have time. That's some of the more formal training. I know that our district pumps out monthly technology notices with training opportunities, so I know that they're there. I often just use the self-paced one to learn because I like to sort of fiddle with it on my own time. (Participant 1, personal communication, November 1, 2022)

> I've received a lot of training from my district. They're always making sure that any kind of technology that they have to give us or they ask us to use, we're well trained with it. Let me see. How often do you seek such training? I seek it less than they give it to us because they're always on top of it. They don't really give us too much time to need to seek it before they say, ‘okay, you're going to get this too, so be ready’. So for that reason, I don't need to seek it because they already know that I need it. So for that reason, I think they do very well. (Participant 6, personal communication, January 11, 2023)

Teachers were asked to reflect on the opportunities they have to collaborate with other teachers at their school site. The responses from the participants of both schools are shown below in Table 6.

Table 6

Interview Question 4: What opportunities do you have to collaborate with other teachers at your school site? What are the results of those discussions? (Two or More Responses)

Response	Total Responses	% to Total Responses
School 1		
Frequent Collaboration	4	28.6%
Implementing Various Platforms	4	28.6%
Usage of Various Devices	4	28.6%
Opportunity to Attend Topic of Choice	2	14.2%
Total	14	100%
School 2		
Frequent Collaboration	5	55.6%
Built-in PLC Time	2	22.2%
Varied Results of Discussions	2	22.2%
Total	9	100%
Major Theme		
1e. Frequent Collaboration		28.6% and 55.6%

Table 6 demonstrates that participating teachers collaborate frequently with other teachers at their site (84.2% of the responses). The next most popular responses came from School 1 participants indicating that during these collaboration opportunities, implementing various platforms (28.6% of the responses) and usage of various devices (28.6% of the responses) are discussed.

Theme 1e. Frequent Collaboration. This theme emerged from the responses of nine of the ten participants (90%). The following excerpts from the interviews support the theme:

> I have a lot of opportunities to collaborate, more with the people immediately around me. The teacher right across the hall, she and I teach similar content so, we'll sometimes sort of go to each other about how to best push out this technology thing. She's also very strong in technology alongside me, so we'll sort of go back and forth or she'll remind me because she's a little bit better at one app. I think that I have a lot of those informal opportunities. I think usually it helps me either better know how to use an app or sometimes I'm stronger with one thing and I'll sort of encourage her to push it out in her class or she's stronger

> with something and then she'll encourage me to push it out. (Participant 1, personal communication, November 1, 2022)
>
> There are a lot of opportunities because our district and our union worked really diligently on having that schedule of how it rotates and how pretty often teachers get to dictate what the training is. So on our site, we are given the opportunity of okay, you want to learn how to use this platform. (Participant 2, personal communication, November 2, 2022)
>
> So here we're very collaborative and three of us on the seventh-grade humanities team are new to the school, which is nice because then like we are just automatically each other's go-to people. But we have our built-in PLC time for the grade level and subject often. At least two Wednesdays per month, we can get together and collaborate. (Participant 3, personal communication, November 14, 2022)
>
> Like school-sanctioned collaboration time. We have PLCs every week, whether it's our own grade level subjects specific, our subject, our grade level, or the whole school. So we do that once a week. We have PLCs. (Participant 5, personal communication, November 17, 2022)

Summary of Research Question 1

The themes that emerged for positive effects and educators' beliefs about implementing instructional technology were as follows: (1a) promotes student engagement; (1b) convenience of accessibility; and (1c) used in moderation. The themes that emerged for training and collaboration were (1d) received district training and (1e) frequent collaboration.

Research Question 2

Research Question 2: How do barriers such as SES and the digital divide affect educator implementation of instructional technology?

The corresponding interview questions were, "How do you define 'access' to technology? How does your students' 'access' to technology at home affect the way it is integrated into the homework you assign? What types of barriers do you encounter with implementing instructional technology in the classroom? What is your experience with

technical issues being resolved in a timely manner? How often are the technology devices within your classroom maintained? How does an administrator's involvement and support impact the way instructional technology is implemented in the classroom and schoolwide?" Tables 7-10 provide a summary of the middle school teacher participants' themes and responses for Research Question 2.

Teachers were asked to reflect on how they define 'access' to technology and how their students' 'access' to technology affects the way they integrate it into the homework they assign. The responses from the participants of both schools are shown below in Table 7.

Table 7

Interview Question 5: How do you define 'access' to technology? How does your students' 'access' to technology at home affect the way it is integrated into the homework you assign? (Two or More Responses)

Response	Total Responses	% to Total Responses
School 1		
Minimal Homework Assigned	3	42.8%
i-Ready Lessons for Homework	2	28.6%
'Access' Defined as 'Availability'	2	28.6%
Total	7	100%
School 2		
Ability to Have Functioning Device	5	45.4%
Minimal Homework Assigned	2	18.2%
Homework Assigned on Google Classroom	2	18.2%
WiFi Hotspot Needed	2	18.2%
Total	11	100%
Major Theme		
2a. Minimal Homework Assigned		42.8% and 18.2%

Table 7 demonstrates that participating teachers assign minimal homework (61.0% of the responses) at both schools. The next most popular response came from School 2 participants indicating that they defined 'access' to technology as the ability to have a functioning device (45.4% of the responses). The next highest response rate

came from School 1 where participants indicated i-Ready lessons are assigned as homework (28.6% of the responses) and ‘access’ to technology is defined as ‘availability’ (28.6% of the responses).

Theme 2a. Minimal Homework Assigned. This theme emerged from the responses of five of the ten participants (50%). The following excerpts from the interviews support the theme:

> I would define access as having it and being in a setting where you can use it effectively. I know with some of our students, that is not something they have once they leave school. So I don't give homework typically. I'll accept late work, but I typically don't give homework because I know that it's kind of a roll of the dice once they leave campus, if they have a working internet connection at home or not. (Participant 1, personal communication, November 1, 2022)

> The low socioeconomic levels of my students make it so that quite a bit of them don't have actual access to technology at home. So, the way I align it is I don't give them additional assignments as homework. The last thing I want to do is give them something else to worry about. I want them to finish their classwork. So what I'll do is I'll say, Hey, whatever your unfinished assignments are, that's your homework. (Participant 2, personal communication, November 2, 2022)

> So I know for a fact that at least one of my students, I'm 92 right now, and at least one does not have Wi-Fi at home. So, I don't assign homework a lot anyway, just philosophically. And when they do have homework, it's usually, well, it's almost, it's always something that we've started in class that they might need a few more minutes to work on. (Participant 3, personal communication, November 14, 2022)

> We, teachers are mindful of that and cautious of the amount of homework given online. One common homework given to students is like i-Ready lessons. But it's done with the understanding that not every student may be able to access the platform, and not every student may have access to charge their Chromebook at home, or wherever they are. So in the sense of access to technology, it is equal across campus, but in the sense of being able to access it because of their home situation, it's not always the same. And I think most teachers, if not all teachers are conscious and considerate of that. (Participant 8, personal communication, January 18, 2023)

Teachers were asked to reflect on the types of barriers they encounter with implementing instructional technology in the classroom. The responses from the participants of both schools are shown below in Table 7.

Table 8

Interview Question 6: What types of barriers do you encounter with implementing instructional technology in the classroom? (Two or More Responses)

Response	Total Responses	% to Total Responses
	School 1	
Potential for Distraction	2	20.0%
Learning Curve for Students	2	20.0%
Wi-Fi Connection Outage	2	20.0%
Uncharged Devices/Lost Chargers	2	20.0%
Device Repair Fee	2	20.0%
Total	10	100%
	School 2	
Wi-Fi Connection Outage	2	50.0%
Limited Access and Resources	2	50.0%
Total	4	100%
	Major Theme	
2b. Wi-Fi Connection Outage		20.0% and 50.0%

Table 8 demonstrates that participating teachers encounter Wi-Fi connection outages (70.0% of the responses) at both schools. The next most popular response came from School 2 participants indicating that they were provided limited access and resources (50.0% of the responses).

Theme 2b. Wi-Fi Connection Outage. This theme emerged from the responses of four of the ten participants (40%). The following excerpts from the interviews support the theme:

> So that Chromebook is like, that's what I said, there are pitfalls to it where we are tying them to that Chromebook that it doesn't make it easy for them to connect to any kind of Wi-Fi sometimes. Even here on campus, sometimes the Wi-Fi goes off and it's like, okay cool, what do we do now? You know, and that's happened a few times this year already. So it's like, okay, and then we have to just do an

> activity in class or something. (Participant 2, personal communication, November 2, 2022)
>
> There might be, you know, some things here or there where their wifi is spotty somewhere or you know, very minor little things like that on occasion. But nothing consistently that you know, really makes me think I can't use any of this stuff in class. (Participant 4, personal communication, November 14, 2022)
>
> They have texts that support Chromebooks and come out with regard to technical issues, like with the internet, right? That's another whole other one. Because that happens often on campus where the internet goes out, and if you don't have a backup, you have nothing to do. I remember last year we had a power outage for four or five hours, the entire school day. There was no internet. We had power come back on, but the internet was out. (Participant 8, personal communication, January 18, 2023)

Teachers were asked to reflect on their experience with technical issues being resolved in a timely manner, as well as how often the technology devices within their classroom are maintained. The responses from the participants of both schools are shown below in Table 8.

Table 9

Interview Question 7: What is your experience with technical issues being resolved in a timely manner? How often are the technology devices within your classroom maintained? (Two or More Responses)

Response	Total Responses	% to Total Responses
School 1		
Quick Resolution of Technical Issues	3	30.0%
Self-Resolve Technical Issues	3	30.0%
District's Maintenance Schedule	2	20.0%
Issuance of Loaner Device	2	20.0%
Total	10	100%
School 2		
Maintenance Frequency of Student Devices Unknown	3	37.5%
Issuance of Loaner Device	3	37.5%
Quick Resolution of Technical Issues	2	25.0%
Total	8	100%
Major Themes		
2c. Quick Resolution of Technical Issues		30.0% and 25.0%
2d. Issuance of Loaner Device		20.0% and 37.5%

Table 9 demonstrates participating teachers expressing that their students are issued a loaner device when their assigned device is damaged or not working (57.5% of the responses) at both schools. The next most popular response rate that came from both schools was that the technical issues participating teachers experience within their classroom are quickly resolved (55.0 % of the responses). The next highest response rate came from School 2 indicating they were unsure about how frequent student devices are maintained (37.5% of the responses).

Theme 2c. Quick Resolution of Technical Issues. This theme emerged from the responses of five of the ten participants (50%). The following excerpts from the interviews support the theme:

> For me, I don't think I've had a big issue that can't be resolved pretty quickly. Being a little bit more tech savvy, I can kind of loop myself around and figure at least a short term fix. But I think if I've had to put a work order in, it's pretty quick. (Participant 1, personal communication, November 1, 2022)
>
> Things are pretty much, I'd say they're resolved pretty quickly. I don't think I've had any problems continuing for more than a day or so. Even with students, like newer students, it takes them a day or two to get into the system and for all their programs to get activated and stuff with their new accounts. But there's nothing like I said that consistently takes days to get situated. (Participant 4, personal communication, November 14, 2022)
>
> So the lightbulb in this LCD projector popped earlier this school year during fifth period, which is our class before lunch. When I came in after lunch, it had been replaced. (Participant 5, personal communication, November 17, 2022)
>
> They're pretty fast in our district to do that, to service anything. It just depends, but I'd say generally speaking, if it's the district servicing our equipment, I'd say they're a pretty good time. (Participant 6, personal communication, January 11, 2023)

Theme 2d. Issuance of Loaner Device. This theme emerged from the responses of five of the ten participants (50%). The following excerpts from the interviews support the theme:

> For student devices, typically I have some extra chargers, but if not, then I just send them to the library to get a loaner while theirs is broken. I don't know what the turnaround time on fixing those would be, but they do get a new device relatively quickly. (Participant 1, personal communication, November 1, 2022)
>
> The students will come in with a broken Chromebook or whatever and I just send them to the library and it's switched out like that. I don't know, they take care of it with the librarian. I don't ever have to solve that in any way or put in any request for them. (Participant 3, personal communication, November 14, 2022)
>
> Usually the library can give them a loaner device so they have something accessible to them, but it takes time for screens to be repaired. (Participant 8, personal communication, January 18, 2023)
>
> If a child has a Chromebook that's not working, I'll send them to the library and she replaces it. So it's been pretty good. I think we're pretty supportive. (Participant 9, personal communication, January 24, 2023)
>
> The students, they're always maintained. We are pretty good at making sure their Chromebooks work. I know our librarian is wonderful, and she really helps out with that. She's down the hall so their Chromebooks are maintained in top working condition pretty much. (Participant 10, personal communication, February 1, 2023)

Teachers were asked to reflect on their experience of how an administrator's involvement and support impact the way instructional technology is implemented in the classroom and schoolwide. The responses from the participants of both schools are shown below in Table 10.

Table 10

Interview Question 8: How does an administrator's involvement and support impact the way instructional technology is implemented in the classroom and schoolwide? (Two or More Responses)

Response	Total Responses	% to Total Responses
School 1		
Admin Support is Impactful/Critical	5	41.6%
Potential to be Supportive or Suppressing	3	25.0%
Administration Turnover	2	16.7%
Limited by Admin's Own Ability	2	16.7%
Total	12	100%
School 2		
Involved and Supportive Admin	3	100%
Total	3	100%

Response	Total Responses	% to Total Responses
Major Theme		
2e. Importance of Supportive Administrator		66.6% and 100%

Table 10 demonstrates how the participating teachers at both schools expressed the importance of an administrator's involvement, and how their support impacts the way instructional technology is implemented in the classroom and schoolwide (66.6% and 100% of the responses). The next highest response rate came from School 1 where participants indicated their recent factors of an administration turnover (16.7% of the responses) and support can be limited by admin's own ability (16.7% of the responses).

Theme 2e. Importance of Supportive Administrator. This theme emerged from the responses of eight of the ten participants (80%). The following excerpts from the interviews support the theme:

> It does play a role I think in the, we have a new administrator this year and so I think in the past we were kind of limited by that principal's own ability to get involved with technology… I do think that their ability to understand what you're doing with technology does help. (Participant 1, personal communication, November 1, 2022)

> I mean, I think it can be everything or nothing, right? I just experienced a turnover of new admin, both new admins, AP and principal. Last year they were just super involved in micromanaging where it negatively affected pretty much everything you did…so, it can be the most supportive thing ever or it can be the most suppressing thing ever because it's like you're stifling any kind of momentum we have, and that's just with cell phones. Chromebooks and all these other things, I mean, yeah, they provide us with more LFDs or just more materials, more tools. So if they want that and they support it, then it becomes easier for us. (Participant 2, personal communication, November 2, 2022)

> Our administrators are very involved in technology themselves. So they're very happy to share things that they have found or that other teachers have found, especially if they notice that a teacher is using something that seems really cool. They're like, oh, can you teach us how to use that? Then they'll bring it to the whole school. (Participant 5, personal communication, November 17, 2022)

> Our current administrator has done a lot. She's made sure we've used, we've put to work our ELOP money this year to make sure that if any teachers have any extra needs. A teacher wanted a whole room of iMacs, and she got it. She already had the iMacs ready, she just needed the updates, and to have the tech team from the district come in and set it up for her. Took care of it within the week. So administrators' involvement is critical if you want to, if you have a plan that's going to improve the integration for students. (Participant 7, personal communication, January 11, 2023)

> So administrators, I think, play a great role in the idea of providing access to technology. So on our campus, our principal or administrator can purchase, right? Different types of licenses that teachers have access to. It's different across the district because not every school uses the same type of applications, although some of them are the same, like ST Math and i-Ready. But other applications, like Nearpod, you have to buy licenses for. So, you know, depending on the goal and the vision of the campus, the needs of the campus, there are instructional tools that the principal can support staff with. (Participant 8, personal communication, January 18, 2023)

> I've had wonderful, wonderful administrators here at our school, and they've been very supportive of the program going forward. They like what we've done, and so we're going to be getting some grants and some money coming in, so our equipment is going to be massively updated. It's going to happen next year when we get some better equipment, but they've told me over and over again that they love what we're doing, and they're going to take care of us. (Participant 10, personal communication, February 1, 2023)

Summary of Research Question 2

The themes that emerged were as follows: (2a) minimal homework assigned; (2b) Wi-Fi connection outage; (2c) quick resolution of technical issues; (2d) issuance of loaner device; and (2e) importance of supportive administrator.

Research Question 3

Research Question 3: What best practices and instructional strategies do teachers use to promote academic achievement and engagement through implementation of instructional technology?

The corresponding interview questions were, “Which software programs do you utilize and integrate most regularly into your lessons to promote engagement? What types of

assignments do you have students complete using these software programs? What type of assessments do you use to determine whether your best practices and instructional strategies implementing instructional technology positively impacted your students? Identify best practices of instructional technology to build positive relationships with your students. What instructional strategies do you use to improve academic achievement levels using educational technology?" Tables 11-14 provide a summary of the middle school teacher participants' codes and responses for Research Question 3.

Teachers were asked to reflect on which software programs they utilize and integrate most regularly into their lessons to promote engagement, as well as the types of assignments they have students complete using those software programs. The responses from the participants of both schools are shown below in Table 11.

Table 11

Interview Question 9: Which software programs do you utilize and integrate most regularly into your lessons to promote engagement? What types of assignments do you have students complete using these software programs? (Two or More Responses)

Response	Total Responses	% to Total Responses
School 1		
Google Workspace	4	26.7%
Nearpod	3	20.0%
Edpuzzle	2	13.3%
Quizizz	2	13.3%
YouTube	2	13.3%
Provides Opportunity for Student Collaboration	2	13.3%
Total	15	99.9%*
School 2		
Google Workspace	4	23.5%
i-Ready	3	17.6%
Gimkit	3	17.6%
Kahoot!	3	17.6%
Padlet	2	11.8%
YouTube	2	11.8%
Total	17	99.9%*

Response	Total Responses	% to Total Responses
Major Themes		
3a. Google Workspace		26.7% and 23.5%
3b. YouTube		13.3% and 11.8%

*Did not add to 100% due to rounding

Table 11 demonstrates that participating teachers utilize and integrate Google Workspace most regularly into their lessons to promote engagement (50.2% of the responses) at both schools. The next most popular response that came from both schools was integrating the use of YouTube (25.1% of the responses). The next highest response rate came from School 1 where participants indicated they utilize Nearpod (20.0% of the responses), whereas participating teachers from School 2 integrate the use of i-Ready (17.6% of the responses), Gimkit (17.6% of the responses), and Kahoot! (17.6% of the responses).

Theme 3a. Google Workspace. This theme emerged from the responses of eight of the ten participants (80%). The following excerpts from the interviews support the theme:

> So Google Suite is pretty large. I do a lot of Google Suite, and a lot of Google Slides. This year, Google Forms in particular. I use the Slides for more collaboration, because the students are seated at tables. Then I do the forms as a formative assessment for them. (Participant 1, personal communication, November 1, 2022)
>
> I primarily use Google Slides because I used to use Google Documents more and like in Sheets as well, but Slides has become, for me, the easiest to organize everything. It's easier to roll out an assignment or a project in bits and pieces through Google Slides where they know exactly where to put their responses. (Participant 2, personal communication, November 2, 2022)
>
> I do have students working in Slides a lot and it's not always Slides that they share. I like the idea that with everything Google, one of them creates it and then shares it with the other, and then you know, they're collaborating just like that. There are a lot of different assignments that I have them do like, aside from word processing of course because we do that a lot, and graphic organizers. (Participant 3, personal communication, November 14, 2022)

> I guess Google Classroom would probably be a part of that and that's more just to have everything sorted out for students. We put the agenda on there, we put our notebook in there, we put homework assignments in there. Students don't actually turn anything in on there, but it's more just to have everything organized for students. So if they ever miss whatever homework assignment it is or whatever, they can always go to Google Classroom and see what we did that day, that week, and that unit. (Participant 4, personal communication, November 14, 2022)

> So for software, we use Google Classroom. Google Classroom is basically your hub. Everything goes through there…Of course, we use Google Docs. I learn something new about Google Docs every day. I mean, not Google Docs per se, but just like the coding tools that you use. (Participant 7, personal communication, January 11, 2023)

Theme 3b. YouTube. This theme emerged from the responses of four of the ten participants (40%). The following excerpts from the interviews support the theme:

> I sometimes have them use YouTube where they link certain things, like in my leadership classes, I have them do goal setting or motivational things where they have to come up with ideas. Then afterward I ask them to find evidence and I just leave it very generic because you can just find a motivational speech, if you want, on YouTube. (Participant 2, personal communication, November 2, 2022)

> YouTube. Love YouTube. You know, whenever we're talking about a certain kind of topic, I'll pick up YouTube video clips and, and play them for the kids to relate. I try to find the most disgusting of things to keep their eyes focused… I don't find videos that these kids are used to. You see, I find videos, like for instance, we're talking about fruit. Somebody says an orange. Yeah, but let me find a different orange. Let me find a blood orange. (Participant 6, personal communication, January 11, 2023)

Teachers were asked to reflect on the types of assessments they use to determine whether their best practices and instructional strategies positively impacted their students when implementing instructional technology. The responses from the participants of both schools are shown below in Table 12.

Table 12

Interview Question 10: What type of assessments do you use to determine whether your best practices and instructional strategies implementing instructional technology positively impacted your students? (Two or More Responses)

Response	Total Responses	% to Total Responses
	School 1	
Google Forms	3	33.3%
Teacher Informal Self-Reflection	2	22.2%
Completion of the Objective	2	22.2%
Quizizz	2	22.2%
Total	9	99.9%*
	School 2	
Project Based Learning	3	42.8%
i-Ready Diagnostic Assessments	2	28.6%
Student Creation of Infographics	2	28.6%
Total	7	100%

*Did not add to 100% due to rounding

Table 12 demonstrates that participating teachers did not have areas of overlap (with two or more responses) at both schools. For School 1, using Google Forms was the top selected assessment form (33.3% of the responses), while Project Based Learning (42.8% of the responses) was the most often response for School 2.

Teachers were asked to identify best practices of instructional technology to build positive relationships with their students. The responses from the participants of both schools are shown below in Table 13.

Table 13

Interview Question 11: Identify best practices of instructional technology to build positive relationships with your students. (Two or More Responses)

Response	Total Responses	% to Total Responses
	School 1	
Beginning of the Year Introductions	2	50.0%
Student Ownership of Learning	2	50.0%
Total	4	100%
	School 2	
High Lesson Engagement	3	60.0%
Provide Students Feedback	2	40.0%
Total	5	100%

Table 13 demonstrates that participating teachers did not have areas of overlap (with two or more responses) at both schools. For School 1, beginning of the year

introductions (50.0% of the responses) and student ownership of learning (50.0% of the responses) were identified as best practices, while high lesson engagement (60.0% of the responses) was the most often response for School 2.

Teachers were asked to reflect on the instructional strategies they use to improve academic achievement levels using educational technology. The responses from the participants of both schools are shown below in Table 14.

Table 14

Interview Question 12: What instructional strategies do you use to improve academic achievement levels using educational technology? (Two or More Responses)

Response	Total Responses	% to Total Responses
School 1		
Provide Students Feedback	3	60%
Implement the Use of i-Ready	2	40%
Total	5	100%
School 2		
Provide and Collect Student Feedback	2	100%
Total	2	100%
Major Theme		
3c. Provide and Collect Student Feedback		60.0% and 100%

Table 14 demonstrates that participating teachers use the instructional strategy of providing and collecting student feedback to improve academic achievement levels (60% and 100% of the responses) at both schools. The next most popular response that came from School 1 was implementing the use of i-Ready (40% of the responses).

Theme 3c. Provide and Collect Student Feedback. This theme emerged from the responses of five of the ten participants (50%). The following excerpts from the interviews support the theme:

> This year is where I'm really experimenting with using Google Forms as my formative assessment. I'm really able to look at them and the questions are all tied to the standard. So I'm able to assess whether or not they are meeting the standards, and I use that as feedback and I give them feedback so that they can

> retake it and basically replace their score. (Participant 1, personal communication, November 1, 2022)
>
> I actually think it might go back to the idea of feedback, just that same kind of real-time feedback on a doc, on a slide, on a drawing, on whatever it is because that's really focused on individual academic achievement. (Participant 3, personal communication, November 14, 2022)
>
> So one thing that I've done and I think about doing more a lot is more like kind of self-assessment stuff. Whether it's like a Google Form, or something like that, where students kind of have to self-evaluate where they are with certain skills and then they actually get that response back where they actually have to look back at it. You know, if they say they feel confident with one skill or they don't feel confident with another. It's kind of that feedback of like, I don't know, it's like that reality of like, okay, I need to work on this then like if I'm comfortable with this. So I don't know what strategy that would be, but it's like a feedback, self-assessment type thing where I think that's helped in the past with students and just seeing where they're at before a quiz or something. So I guess that's educational technology just because it's like a Google Form or something. So Google Forms and getting their feedback. To promote academic achievement, just to kind of see where they're at. (Participant 4, personal communication, November 14, 2022)
>
> One instructional strategy I like to do is the test chat… We do chats where we talk to the kids and this is how you did last time, and this is what I expect you to do this time on your i-Ready test or on your i-Ready lessons. This is what you're currently having a problem with. You have a red flag here because you finished too quickly and you've been stuck on this lesson for two weeks. That's a problem. So I pull them in one by one and we have these conversations. Another thing I do is I also, when they get their score, whether it's a good score or a bad score, I show them their historical results from the previous year. (Participant 7, personal communication, January 11, 2023)
>
> We have one-on-one chats with students or small group chats with students when we notice how they're doing or where their levels are. Either in reading or in math. I think that in itself, it opens the door for that small group instruction or that small group intervention. So through these platforms online, we're able to assess quickly where students are and develop a tier two intervention to help them. (Participant 8, personal communication, January 18, 2023)

Teachers were asked if there was anything else they would like to add to their responses. The responses from the participants of both schools are shown below in Table 15.

Table 15

Interview Question 13: Is there anything else you would like to add? (Two or More Responses)

Response	Total Responses	% to Total Responses
	School 1	
Does Not Have Anything To Add	2	50.0%
Fear of Instructional Technology Implementation	2	50.0%
Response	Total Responses	% to Total Responses
Total	4	100%
	School 2	
Does Not Have Anything To Add	3	100%
Total	3	100%
	Major Theme	
3d. Does Not Have Anything To Add		50.0% and 100%

Table 15 demonstrates that participating teachers did not have anything else to add to their responses at the conclusion of their interview (50% and 100% of the responses) at both schools. The next most popular response that came from School 1 was the belief that some teachers do not implement instructional technology due to fear (50% of the responses).

Theme 3d. Does Not Have Anything to Add. This theme emerged from the responses of five of the ten participants (50%). The following excerpts from the interviews support the theme:

> No, I can't really think of anything. I mean, that's mostly what I use instructional technology for. I don't think I have anything to add. (Participant 1, personal communication, November 1, 2022)
>
> I don't think so. I'm excited to see the next steps and I'm definitely going to be following this and I'm excited to see what the participants have to say and like what you suggest are the next steps and the findings. I think it's going to be really exciting. But I don't think there's anything else I'd like to add. (Participant 3, personal communication, November 14, 2022)
>
> No. I think I shared as much as I could share my beliefs about technology. (Participant 8, personal communication, January 18, 2023)
>
> No, I'm, I'm good. I'm just I, I love educational technology. (Participant 10, personal communication, February 1, 2023)

Summary of Research Question 3

The themes that emerged were as follows: (3a) Google Workspace; (3b) YouTube; (3c) provide and collect student feedback; and (3d) does not have anything to add.

Summary

The purpose of this comparative case study was to explore the benefits of effective technology integration in the classroom, as well as the best teaching practices related to instructional technology. The participants in this study were teachers who provided insight into their experiences as middle school teachers.

Based on the research findings, it became evident that the participants' beliefs about using instructional technology affect its implementation. The teachers expressed the positive effects of instructional technology, including promotes student engagement and allows content to be conveniently accessible. While the participants understood the benefits of implementing instructional technology, they noted that they prefer to use it in moderation in accordance with the assignments. The participants' awareness of instructional technology implementation was a culmination of the district trainings they have received, as well as the frequent collaboration opportunities they have with their colleagues. Such opportunities have provided the teachers the space to learn and discuss various software platforms and implementation.

Through the interviews, the participants shared a wide variety of barriers that affect their implementation of instructional technology, including students' socioeconomic status and school site's Wi-Fi outages. The technical issues teachers encounter in their classrooms are quickly resolved, including how fast students are

issued a loaner device while their Chromebook is repaired. Nonetheless, almost all participants expressed how crucial it is to have an administrator's support in the implementation of instructional technology in the classroom and schoolwide.

Through the research findings, teachers implement a variety of best practices and instructional strategies to promote academic achievement and engagement through the implementation of instructional technology. The participants utilize software programs such as Google Workspace and YouTube for assignments, assessments, to improve academic achievement levels, and build positive relationships with students by providing and collecting their feedback.

The questions on the interview protocol were designed to provide information for the research questions. The research questions were developed to discover connectivism learning theory practices of middle school teachers as identified in the theoretical framework for this study: autonomy, openness, connectedness, and diversity. The following chapter outlines the recommendations and conclusions for this study.

CHAPTER FIVE

RECOMMENDATIONS AND CONCLUSIONS

Overview

The purpose of this comparative case study was to explore the benefits of effective technology integration in the classroom, as well as the best teaching practices related to instructional technology. While instructional technology implementation is common in our present day classrooms, there are current educational challenges that require further examination to address academic inequities, such as the digital divide; educator beliefs, and; barriers educators experience, both internally and externally. By preparing students with a developed skill-set in instructional technology, they have the power to transform their lives beyond their schooling (Rogers, 2016). Educators must examine their work through the lens of the learner in becoming transformational (Hoffman & Vorhies, 2017).

There is a variety of necessary factors for implementation of instructional technology in education to be effective. Researchers have examined the problem regarding the lack of technology implementation due to teachers' beliefs and their minimal knowledge of how to do so, lack of access to technology, and lack of motivation to implement what they have learned through professional development (MacArthur & Malouf, 1991; Thornton, 2017; Burkholder, 2012). Educators are also faced with daily external and internal barriers that hinder their implementation of instructional technology (McLoughlin et al., 2008).

The researcher conducted a comparative case study using a qualitative design. An individual participant interview was conducted to gain insight from fellow educators

on their implementation of instructional technology. A comparative case study was determined to be best suited for this research study. Because teachers are a major element of instructional technology implementation, this study sought to identify if the digital divide, beliefs, professional development, and administrative support are, in fact, variables that need to be considered for successful implementation of instructional technology. Through the interview process, the participants were given the opportunity to answer questions in regards to their integration of instructional technology.

A case study research methodology focuses on an individual, partnership, small group, or an organization's qualitative responses to a set of interview questions or observations (Creswell & Poth, 2018). This research methodology is a qualitative approach in which the researcher explored a real-life case, or multiple cases, over time by collecting in-depth data through a variety of information sources (Creswell & Poth, 2018). In this collective case study, multiple cases were selected by the researcher to demonstrate varying perspectives on the issue (Creswell & Poth, 2018).

Summary of Findings by Research Question

Based on the research findings, teachers' beliefs about instructional technology affect the how it is implemented. The positive effects teachers expressed about instructional technology implementation includes promotion of student engagement and allows content to be conveniently accessible. Considering these benefits, the teachers have chosen to implement the technology in moderation. The participants have grown their awareness of positive effects by receiving district training and collaborating frequently.

The findings demonstrate that the barriers teachers encounter when implementing instructional technology in the classroom include: students' socioeconomic status and school site's reliability of wireless internet connection. The technical issues teachers encounter are quickly resolved, as well as the issues students experience with their district-issued device. The greatest barrier the teachers expressed was the importance of a supportive administrator, and how that can have a major role in the way instructional technology is implemented in the classroom and schoolwide.

Through the research findings, teachers implement a variety of best practices and instructional strategies to promote academic achievement and engagement through the implementation of instructional technology. The participants implement the usage of various software programs, such as Google Workspace and YouTube, to provide and collect feedback in an effort to improve academic achievement and build positive relationships with students.

The following table (Table 16) demonstrates how the findings of the study aligned with Connectivism Learning Theory.

Table 16

Common Best Practices Used by Middle School Teachers Relative to the Theoretical Framework

Diversity	Autonomy	Openness	Interactivity
• Received District Training	• Frequent Collaboration • Importance of Supportive Administrator • Minimal Homework Assigned	• Promotes Student Engagement • Used in Moderation • Does Not Have Anything to Add	• Convenience of Accessibility • Quick Resolution of Technical Issues • Issuance of Loaner Device

Diversity	Autonomy	Openness	Interactivity
			• Wi-Fi Connection Outage • Google Workspace • YouTube • Provide and Collect Student Feedback

Table 16 demonstrates the major themes from the participants' responses organized by the four factors of connectivism learning theory. For the factor of diversity, (a) received district training (82.8% of the responses) was the only major theme that aligned. For the factor of autonomy, there were three major themes that corresponded; however, (a) importance of supportive administrator (166.6% of the responses) had the highest percentage of responses. For the factor of openness, (a) used in moderation (66.6% of the responses) was the theme with the highest percentage of responses. For the factor of interactivity, (a) Wi-Fi Connection Outage (70.0% of the responses) was the greatest barrier teachers encounter when implementing instructional technology.

Recommendations for Educational Leaders

As a result of this study, there are internal and external barriers that educators encounter in the classroom on a daily basis. Educational leaders should have an awareness of their students' access to technology at home and the potentiality of a digital divide existing. Through the interview process, the teacher participants shared they remain conscious if the homework they assign requires home internet access. This

is important because although each student has a district-issued device, teachers are aware that students' home and living situations vary. Gonzales et al. (2020) posited that the digital divide is not only a concern of who has access to the internet, but also *how* the internet and digital communication technologies are used.

In regards to school infrastructure, both sites have a wide variety of technology equipment in the classroom that is available for students to use. Teachers from both sites expressed they had their administrator's support for instructional technology and that support has had a positive impact on technology implementation in the classroom and schoolwide. This finding is in alignment with the research by Daniel and Nance (2002) that showed the involvement of school administrators is crucial in all levels of planning and technology integration schoolwide. It is imperative that administrators be cognizant of how their support, or lack thereof, impacts not just the teachers, but the lives of their students and students' learning.

This research demonstrated that it is crucial for all educational leaders and administrators to be receptive as well as maintain an open mind about the benefits and range of capabilities instructional technologies offer. In addition, it is also important for educational leaders to attend instructional technology training or professional development opportunities to build an awareness of software programs that can be utilized and integrated into lessons to promote student engagement and academic success (Lu & Overbaug, 2009; Daniel & Nance, 2002). Furthermore, educational leaders should establish and maintain a sense of community with their colleagues where they are able to provide and seek support from one another. Participants from both sites expressed how they were provided time to collaborate regularly with their

team(s), in which they have conversations regarding how or which technology they should utilize and implement in the classroom (Lu & Overbaugh, 2009).

Next Steps for Educational Reform

Based on the results of this comparative case study, effective communication about technology used in the classroom is an important factor for student academic success. This communication needs to take place among teachers between teachers, teachers and site-level and district-level administrators; but most importantly, between teachers and students. One of the most common responses that came from the participants was how they collected and provided student feedback to not only improve academic achievement levels, but to build positive relationships with their students as well. This finding is adding new information to the research. Moving forward, district facilitators should prioritize supporting teachers with a training on how to implement instructional technology and various platforms to effectively communicate with students by providing them real-time feedback. Such strategies will be beneficial to the teacher when communicating to all school stakeholders, including parents. The district can continue to provide training opportunities to their teachers in various forms of modalities, such as in-person, virtual, or independent. Teachers should be provided the opportunity to attend site-based or district-based trainings, as well as conferences.

Parental involvement in a child's education is one of the most important factors in a student's success. To promote parents' technological efficiency, the district could offer support through a parent advisory committee the specifically focuses on technology. District facilitators should also provide trainings and learning opportunities to all parents. In doing so, it is important to be inclusive of all cultures within the community; therefore,

such trainings, webinars, and conferences should be available to parents in their native language. At the site level, schools should provide a family night that focuses on the different platforms their teachers use. By hosting such an event, not only would parents' increase technological efficiency, but it would ultimately also help parents become more comfortable in being able to support their child at home.

Through the interview process, it became apparent that teachers use the same software programs different ways. Another recommendation would be that teachers should visit model schools to provide them with an opportunity to observe how instructional technology is being integrated into different subject areas and grade levels, which can inspire them to try new approaches in their own classrooms. For example, teachers can observe model teachers implementing the use of the Google Workspace, specifically Slides and Forms, which were two of the most common platforms mentioned by the participants. By visiting model schools, teachers would be able to gain the perspective of how else the same platform can be implemented in the classroom when creating a wide variety of assignments.

Recommendations for Future Research

The theoretical framework in the literature review consisted of four factors within connectivism learning theory: (a) diversity, (b) autonomy, (c) openness, and (d) interactivity. These factors contribute to conncectivism learning theory practices in two middle schools by its teachers. The following are recommendations for future research:

1. Researchers should observe implementation of instructional technology by the participants, including both, hardware as well as software platforms utilized (Hohlfeld et al., 2017). By observing implementation of platforms, such as Google

Workspace, the researcher acquire instructional practices and ideas that can be shared with other educators in an effort to improve student academic success and technological skill-set (MacArthur and Malouf, 1991).

2. Researchers should expand the study by increasing the amount of participants to gain a wider perspective of how instructional technology can be implemented in the classroom, as well as the internal and external barriers teachers encounter (MacArthur & Malouf, 1991).
3. Researchers should conduct a comparative case study of two sets of middle schools (one Low-SES and one Mid-High SES), each set from a different district (Hohlfeld et al., 2017), to determine if there is a difference of implementation strategies across districts.
4. Researchers should identify if a correlation exists between parents' technological skill-set, students' technological skill-set, and student achievement (Gonzales et al., 2020; Rogers, 2016). Future research should explore if parents' technological skill-set influences their child's own skill-set and academic achievement. Are students' more successful if their parent has a greater awareness of the benefits of instructional technology?
5. Future research should examine promoting parents' technological efficiency through trainings and learning opportunities. Does parental involvement in a child's education increase when parents' technological efficiency is promoted?
6. Future research should examine best practices of elementary and high school teachers who implement instructional technology regularly to identify which

hardware and software programs are the most beneficial student learning across primary and secondary educational levels (Hohlfeld et al., 2017).

Limitations of the Study

This study had several limitations, including the sample size population only included five middle school teachers from each site (2) for a total of 10 participants. In addition, the research was limited in that only one school district was used. The researcher utilized a semistructure interview protocol to gather responses from all participants. Participation in the study was voluntary; therefore, it is possible for the data to be bias since they were collected from the information participants were willing to share during their interview. The research findings may not contain generalizability or apply to other school districts or middle schools.

Conclusions

The purpose of this comparative case study was to explore the benefits of effective technology integration in the classroom, as well as the best teaching practices related to instructional technology. The need for this study centered on equity, student engagement, and academic achievement. The results of this study contribute to the field of instructional technology implementation, particularly middle school teachers who are seeking inspiration on how to best reach their students.

After analyzing the data from the participant interviews, the following 12 best practices of middle school teachers were produced and themes were identified: (a) use of Google Workspace in instruction, (b) use of YouTube in instruction, and (c) use of student feedback. For educators' beliefs, the following themes were identified: (a) promoted student engagement, (b) noted convenience of accessibility, (c) used in

moderation, (d) received district training, and (e) identified frequent collaboration. The following themes that emerged for barriers affecting educator implementation of instructional technology were identified: (a) minimal homework assigned, (b) Wi-Fi connection outage, (c) resolution of technical issues (speed), (d) issuance of loaner device, and (e) importance of supportive administrator.

The ultimate goal of this research was to discover best teaching practices of instructional technology implementation. The researcher wanted to gain insight from other teachers about their experiences, in hopes to acquire strategies that could be shared at school sites to positively impact students' learning and academic achievement. Educational leaders must remember that great teachers will never be replaced by technology, but technology in the hands of great teachers is transformational (Couros, 2014). As a result of this study, I am reminded that student success is a team effort based on communication, relationships, and shared expertise.

APPENDIX A

CONSENT TO PARTICPATE IN RESEARCH

INSTRUCTIONAL TECHNOLOGY IMPLEMENTATION:
BARRIERS IMPACTING STUDENT SUCCESS

IRB Approval Number: IRB-FY2022-329

INFORMED CONSENT

The study in which you are being asked to participate is designed to investigate best practices of instructional technology implementation and the barriers impacting student success. This study is being conducted by Roxanna Zendejas under the supervision of Dr. Sharon Brown-Welty, Co-Director, California State University, San Bernardino. This study has been approved by the Institutional Review Board, California State University, San Bernardino.

PURPOSE: The purpose of this comparative case study is to explore the benefits of effective technology integration in the classroom, as well as the best teaching practices related to instructional technology. Current educational challenges regarding instructional technology implementation require further examination to address academic inequities, such as the digital divide; educator beliefs, and; barriers educators experience, both internally and externally.

DESCRIPTION: I will conduct semi-structured, open-ended interviews with 10-15 participants to gain insight to their implementation of instructional technology. I would like to acquire your perspectives, along with beliefs, about instructional technology and the barriers you witness, including the digital divide. After interviews have been conducted, I will provide each participant the interview transcript to review for accuracy and meet with them to go over their revisions.

PARTICIPATION: Your participation is completely voluntary and you do not have to answer any questions you do not wish to answer. You may skip or not answer any questions and can freely withdraw from participation at any time. Refusing to participate or withdrawing from participation in the middle of the research will not affect your employment as a teacher.

If you decide to participate in this study, I will ask you to do the following:

1. Participate in an interview (45 to 60 minutes) with the researcher, Roxanna Zendejas. You may select the location (your school, virtual format, other). The following interview and general questions will be asked:
    1) What are the positive effects you find with implementing instructional technology?
    2) How do your beliefs and perspectives about using educational technology impact the way you integrate its use?
    3) What kind of support and training have you received with integrating technology into the curriculum and how often do you seek such training?
    4) What opportunities do you have to collaborate with other teachers at your school site? What are the results of those discussions?

5) How do you define ‘access’ to technology? How does your students’ ‘access’ to technology at home affect the way it is integrated into the homework you assign?
6) What types of barriers do you encounter with implementing instructional technology in the classroom?
7) What is your experience with technical issues being resolved in a timely manner? How often are the technology devices within your classroom maintained?
8) How does an administrator’s involvement and support impact the way instructional technology is implemented in the classroom and school wide?
9) Which software programs do you utilize and integrate most regularly into your lessons to promote engagement? What types of assignments do you have students complete using these software programs?
10) What type of assessments do you use to determine whether your best practices and instructional strategies implementing instructional technology positively impacted your students?
11) Identify best practices of instructional technology to build positive relationships with your students.
12) What instructional strategies do you use to improve academic achievement levels using educational technology?
13) Is there anything else you would like to add?

2. Allow the interview to be recorded to be recorded using an audio recorder so that accurate transcription of the interview can occur.
3. You will be given the opportunity to review the transcription of you interview for accuracy, provide interpretation if necessary.

CONFIDENTIAL: For purposes of confidentiality, you will be provided a number, which will be used in the study (ex: Participant 1). The audio recording of the interview will be password protected. The device will be stored in a locked cabinet in the researcher’s home/office in Indio, CA. When data collection is completed, the audio file will be destroyed. Any information that is obtained in connection with this study and that can be identified with participants will remain password protected and will be disclosed only with permission of the participant or as required by law.

RISKS: The potential risk to the participants is minimal. Possible minimal risks include exposure to some personal information to the researcher, potential for your participation to be inferred through interaction with the researcher, and the possibility of the interview question will bring up something that may involve negative or emotional reactions. In order to protect the research participants, information will be confidential. No identifiable names, schools, or districts will be reported in the study. Participants will be reminded to not state students' names or personal details during the interview discussion, as they run the risk of violating their students' privacy. Participants will also be reminded to speak about general issues rather than particular ones that could potentially identify an individual. I understand the possible risk to individuals if personal identifiable information is used; therefore, a number will be used to identify the participants (ex: Participant 1).

BENEFITS: Participants may be prompted to reflect on their instructional practices as a result of their participation, which in turn, provides them with the opportunity for

professional growth. Additionally, this study will contribute to the knowledge and literature regarding barriers impacting student success, as well as instructional technology best practices by middle school teachers.

VIDEO/AUDIO/PHOTOGRAPH:
Please Initial the Following:
_____ I understand this research will be Video Recorded (If virtual format is chosen.)
_____ I understand that this research will be Audio Recorded

CONTACT: If you have any questions or concerns about the research, please feel free to contact Dr. Sharon Brown-Welty (xxxxxxx@xxxxx.edu or xxx-xxx-xxxx) or Roxanna Zendejas (xxxxxxxxx@xxxxxx.xxxxx.edu or xxx-xxx-xxxx).

RESULTS: Research results will be reported in the final dissertation, which will be published in ScholarWorks. Results will also be presented at the researcher's final defense.

CONFIRMATION STATEMENT:

_____ I have read the information above and agree to participate in your study.

Signature: _____ Date: _____

APPENDIX B

INSTITUTIONAL REVIEW BOARD APPROVAL

Date: 5-4-2023

IRB #: IRB-FY2022-329
Title: Instructional Technology Implementation: Barriers Impacting Student Success
Creation Date: 5-29-2022
End Date:
Status: Approved
Principal Investigator: Sharon Brown-Welty
Review Board: CSUSB Main IRB
Sponsor:

Study History

Submission Type Initial	Review Type Expedited	Decision Approved

Key Study Contacts

Member Roxanna Zendejas	Role Co-Principal Investigator	Contact
Member Stephen Bronack	Role Co-Principal Investigator	Contact
Member Sharon Brown-Welty	Role Principal Investigator	Contact
Member Sharon Brown-Welty	Role Primary Contact	Contact

APPENDIX C

INTERVIEW PROTOCOL

1. What are the positive effects you find with implementing instructional technology?
2. How do your beliefs and perspectives about using educational technology impact the way you integrate its use?
3. What kind of support and training have you received with integrating technology into the curriculum and how often do you seek such training?
4. What opportunities do you have to collaborate with other teachers at your school site? What are the results of those discussions?
5. How do you define ‘access’ to technology? How does your students’ ‘access’ to technology at home affect the way it is integrated into the homework you assign?
6. What types of barriers do you encounter with implementing instructional technology in the classroom?
7. What is your experience with technical issues being resolved in a timely manner? How often are the technology devices within your classroom maintained?
8. How does an administrator’s involvement and support impact the way instructional technology is implemented in the classroom and schoolwide?
9. Which software programs do you utilize and integrate most regularly into your lessons to promote engagement? What types of assignments do you have students complete using these software programs?
10. What type of assessments do you use to determine whether your best practices and instructional strategies implementing instructional technology positively impacted your students?
11. Identify best practices of instructional technology to build positive relationships with your students.
12. What instructional strategies do you use to improve academic achievement levels using educational technology?
13. Is there anything else you would like to add?

APPENDIX D

CERTIFICATION FOR PROTECTION OF HUMAN SUBJECTS

CITI PROGRAM

Completion Date 12-Sep-2020
Expiration Date 11-Sep-2025
Record ID 38406548

This is to certify that:

Roxanna Zendejas

Has completed the following CITI Program course:

Not valid for renewal of certification through CME. Do not use for TransCelerate mutual recognition (see Completion Report).

Human Research (Curriculum Group)
Social Behavioral Research Investigators and Key Personnel (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

California State University, San Bernardino

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w991a8de5-a1a6-4441-8eb5-964ec445fbb3-38406548

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