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Eighth-Grade Teachers' and Students' Experiences With iPads in Math Inclusion Classes

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This is to certify that the doctoral dissertation by

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MA, Education Administration, California State University San Bernardino, 2010

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Dissertation Proposal Submitted in Partial Fulfillment

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Abstract

Although educators have embraced technology in mathematics inclusion classrooms, students with math learning disabilities (MLD) still have anxiety and negative attitudes about mathematics and score lower than their counterparts. The purpose of this qualitative single case study was to investigate and describe the experiences of middle school 8th grade inclusion iPad math app users. The technological pedagogical content knowledge model, the universal design for learning model, and the experiential learning theory provided the conceptual framework of technology integration. The research questions addressed the experiences of middle school inclusion teachers and students with MLD regarding iPad use in a Common Core standards-based math curriculum. Two inclusion co-teachers and 8 special education students from 2 inclusion classes in a middle school participated in the study. Data were collected from direct lesson observations, document analysis, and individual teacher and student interviews. An interpretative approach of clustering codes and categories was employed to identify emerging themes. Findings indicated that iPads increased student engagement and student access to the Common Core math curriculum. Teachers and students using iPads faced some challenges including lack of knowledge of using text-to-speech and keeping up with relevant new apps. Educators may use findings to understand how technology integration can provide equal access to the Common Core standards-based math curriculum for students with MLD and can reduce learning barriers for all students.

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Dedication

This is to honor Blessing Nolwazi Ncube and Carol Nontobeko Ncube who encouraged me throughout the journey.

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Chapter 1: Introduction to the Study

Al-Mashaqbeh (2016) maintained that education policymakers value technology as a motivation factor to student learning and to improve learning experiences. One example of policy in education that mandates an instruction for a deeper conceptual knowledge and technology integration to improve learning experiences is the introduction of new math standards. Kontkanen et al. (2017) maintained that the mandates of the rigorous expectations from the math standards include an in-depth approach to instruction and learning leading to more elementary, middle, and high school classrooms having iPads, including special education (Ok & Kim, 2017; Wang, 2017). Investigating the experiences of iPad users in middle school math inclusion classrooms may inform stakeholders regarding math instruction for special education inclusion students.

Although several studies addressed technology use with students with special needs (Bottge et al., 2015; Flewitt, Kucirkova, & Messer, 2014; Miller, 218), only a few studies only targeted use of iPads in math learning (Al-Mashaqbeh, 2016; Anderson, Griffith, & Crawford, 2017; Kirkpatrick et al., 2018; O'Malley, Lewis, Donehower, & Stone, 2014). Hilton (2018) and Townsend (2017) maintained that research addressing the impact of iPad integration in the curriculum is limited. Kaufman and Kumar (2018) also maintained that research about the use of tablets in one-to-one initiatives is limited. Although the Common Core standards have been widely adopted, little is known about how inclusion special education learners and inclusion teachers experience the use of iPad apps in Common Core standards-based math classes at the middle school level in the United States.

Some special needs students are challenged by math calculation skills and trail their counterparts at the middle school level resulting in lower special education students' graduation rates at the high school level (Tan & Kastberg, 2017). Public Law 94-142 of 1975 influenced several changes in special education (Freeman, Yell, Shriner, & Katsiyannis, 2019). The impact of such education policies has been an increase in inclusion classrooms providing students with equal opportunities in accessing the curriculum (Ahmed, 2018; Powell, 2015). In inclusion classrooms, regular education teachers are the experts in content knowledge while special needs teachers are highly qualified in providing special education-related services.

For decades one major concern in student achievement in mathematics has been that U.S. students' performance in mathematics has fallen behind their international counterparts (Schuetz, Biancarosa, & Goode 2018). As a result, recent education policy raised academic expectations for all students in all subjects including mathematics (Marita & Hord, 2017). According to McGuinn (2016), the Every Student Succeeds Act of 2015 (ESSA) gave states more authority in education policymaking. However, like in the NCLB Act, ESSA requires use of academic standards, assessments, and accountability systems by states for all students (McGuinn, 2016). One important requirement that puts pressure on educators is that the assessments must be based on challenging standards including for mathematics (McGuinn, 2016). Students must be assessed in mathematics annually in elementary school from Grade 3 to middle school in Grade 8, and in 11th grade in high school (Hernandez, 2018). Another major requirement of ESSA is that all assessments must have accommodations for learning (McGuinn,

2016). Universal design for learning (UDL) principles give guidance to pedagogical strategies that meet learning needs for all students (Hall, Cohen, Vue, & Ganley, 2015). According to ESSA, states must close achievement gaps between special education students and their counterparts by setting ambitious goals in areas of achievement.

For most of the school day, students with challenges in learning are mainstreamed and held to the same academic performance expectations as general education students (Cook & Rao, 2018). Raised expectations for all students have led to educators looking for innovative ways of making the curriculum accessible to all students. In the past two decades, the major special education reform has been inclusion that encompasses the provision of accommodations to enable equal academic opportunities for all students (Cook & Rao, 2018; Fuchs et al., 2015). In recent years, use of technology for education purposes has expanded (Harrison & Lee, 2018; Kirkpatrick et al., 2018) because educators have placed importance on technology integration in pedagogy (Mulcahy, Maccini, Wright, & Miller, 2014; Zakrzewski, 2016). Inclusion teachers have embraced innovative instructional approaches, such as technology integration, stemming from the UDL framework (Vitelli, 2015). Since iPads were introduced in 2010, various education settings have increased their integration into the curriculum (Harrison & Lee, 2018; Wishard, 2015; Young, 2016). Investigating the experiences of iPad users in an inclusion math curriculum may provide insight on issues related to using technology in inclusion math classrooms to inform instruction and learning of special education inclusion students who struggle with math learning. Several researchers explored iPad use by students on the autism spectrum (Allen, Hartley, & Cain, 2016) and use of iPads in

elementary school classrooms (Ok & Bryant, 2016; Zhang, Trussell, Gallegos, & Asam, 2015). However, researchers have not sufficiently addressed the experiences of iPad app users in inclusion classrooms (Hilton, 2018). Although students with learning disabilities have been using other technologies such as the computer, they still have lower academic achievement compared to regular education students (Schulte & Stevens, 2015). In this study, the objective was to investigate what iPad users say about using iPad apps in Common Core math classrooms.

Chapter 1 is organized in the following manner. First, I provide a description of the problem justifying the study and the inquiry questions. Next is an explanation of the theoretical lenses and the technology integration concept guiding the study. Finally, I define the academic vocabulary, state the assumptions, identify the scope and parameters, and explain the relevance of the study.

Background

In the last decade, more special education students have been mainstreamed and educators have been required to use evidence-based teaching practices to improve the academic performance of inclusion students (Bicehouse & Faieta, 2017). The mandates of the Individuals with Disabilities Act of 2004 include providing research-based strategies based on the principles of the UDL framework to remove barriers to learning for inclusion students (Bicehouse & Faieta, 2017). UDL principles give guidance to pedagogical strategies that meet learning needs for all students (Hall et al., 2015). From 2015, ESSA has given more authority in education policy to the states (McGuinn, 2016). However, like NCLB, ESSA requires education systems based on challenging academic

standards and accountability systems (McGuinn, 2016). Critical thinking is one of the mandates of the Common Core standards because it is regarded as a prerequisite for academics and success for employees (Lee & Choi, 2017). In addition, current education policy emphasizes college and career readiness for all students (Erdogan & Stuessy, 2015). Federal legislation holds schools accountable for all students' academic progress (Moldt, 2016) despite the challenges of teaching critical thinking in mathematics to students with learning disabilities. In spite of the increased rates of inclusion with the goal of improving the academic performance of all students, special education students have fallen behind in math performance throughout all grade levels compared to their counterparts. Schulte and Stevens (2015) corroborated this assertion by describing achievement gaps between special education students and nonspecial education students. However, earning a high school diploma is crucial in the employment sector and in higher education (Watt, Watkins, & Abbitt, 2016). Students are required to complete higher math courses to graduate high school (Watt, Watkins, & Abbitt, 2016). As a result, educators have placed importance on the acquisition of math skills by all students at the middle school level because they lay the foundation for student performance in math at the high school level (Ocumpaugh, San Pedro, Lai, Baker, and Borgen, 2016). There is a positive correlation between student engagement in a middle school math game app and interest in STEM careers at high school (Ocumpaugh, San Pedro, Lai, Baker, and Borgen, 2016). Teachers are constantly looking for innovative strategies, supports, and tools to support math learning for all students (Al-Mashaqbeh, 2016). Technology integration has been seen as a means of providing tools to develop students' critical thinking skills (Lee

& Choi, 2017), which has influenced technology-enhanced pedagogy (Ogbuanya & Efuwape, 2018). Educators utilize technology such as iPads to create interactive learning experiences, and iPads allow teachers to design instruction to personalize learning activities that meet students' learning needs (Al-Mashaqbeh, 2016).

Despite increased rates of inclusion, special education students still have lower academic achievements compared to their counterparts (Tan & Kastberg, 2017). Even though it has been many years after NCLB, there is still a gap between special education students' achievement and their counterparts' (Schulte & Stevens, 2015) at all grade levels. ESSA requires states to close achievement gaps among different student subgroups (McGuinn, 2016). In 2013, the gap in the Algebra 1 average scaled score between 12th grade special education students and their counterparts was 40 points, while for eighth grade students the gap was 46 points (Watt et al., 2016). Special education students had lower academic performance than their counterparts in fourth-grade mathematics, and those in Grades 8 and 12 scored even lower (Bottge et al., 2015). In the years 2009, 2011, and 2013, students in the eighth grade who had a passing grade in math were 33%, 33%, and 31% respectively for special education students compared to 76%, 77%, and 78% respectively for regular education students (Bottge et al., 2015). Special education students trailed 30 points behind general education students scoring at or above proficient and advanced in the 2015 mathematics assessment nationwide, while in California students with learning disabilities trailed by 32 points (National Assessment of Education Progress, 2015). The wide gap in math performance demonstrates a need for

research on effective practices that could be used in Common Core math inclusion classes to support students with math learning disabilities (Watt et al., 2016).

Schools are held accountable for high school graduation rates for all students even though students are challenged by the new Common Core standards (Watt et al., 2016). Completion of certain math courses such as Algebra1 by all students is a prerequisite for students to receive a diploma in many districts (Watt et al., 2016). Earning a high school diploma is crucial because students can seek gainful employment or pursue higher education (Watt et al., 2016). Cook and Rao (2018) stated that for most of the school day, a large number of special education students are mainstreamed and, like their general education peers, are expected the meet the rigorous curriculum standards. The goal of mainstreaming special education students is to provide them with access to the curriculum that will prepare them for success in higher level mathematics classes. However, inclusion students face challenges in math courses and struggle to meet high school graduation requirements as evidenced by the wide achievement gaps in mathematics in 2013 (Watt et al., 2016). Research has established that a well thought out integration of technology can accommodate students' learning needs (Ok & Bryant, 2016) and improve learning experiences of students with learning disabilities. IPad use has become prevalent in inclusive classrooms (Anderson et al., 2017; Ok & Bryant, 2016). However, empirical studies addressing iPad use in inclusion classrooms have been limited, and teachers face challenges with integration (Harrison & Lee, 2018; Maich & Hall, 2016).

The lack of improvement in math academic performance for special education students is due to limited research on math interventions (Bottge et al., 2015; Tan & Kastberg, 2017). Low academic achievement by special education students is due to lack of basic academic skills and resilience in academic tasks (Watt et al., 2016). Several studies in student achievement in mathematics have shown that growth in math increases in the primary grades and slows in higher grade levels (Bottge et al., 2015; Watt et al., 2016). Although researchers have explored iPad use for learners with autism (Wishard, 2015), researchers have not explored experiences of iPad users in classrooms at higher grade levels (Wishard, 2015) and in inclusion classrooms. There was need for further research on iPad use by teachers and students in inclusion mathematics classrooms to provide recommendations on pedagogical strategies that would help improve learning experiences of special education students.

Problem Statement

Although many educators have embraced the integration of technology in the curriculum, including the use of iPads in mathematics inclusion classrooms, students with math learning disabilities (MLD) still have anxiety and negative attitudes about mathematics (Larkin & Jorgensen, 2016) and continue to score lower than their counterparts. I investigated the experiences of teachers and special education students in eighth grade inclusion classrooms using iPads in a Common Core math curriculum. Over the years, legislation and changes in math content standards have been instrumental in the increase of special education students in mainstream classes (Powell, 2015). One of the federal mandates has been the integration of technology in instruction and learning

(Davidson, Richardson, & Jones, 2014). According to education policymakers, technology integration is a factor in improving learning experiences and academic performance of students (Davidson, Richardson, & Jones, 2014). As a result, more K-12 classrooms have included the use of iPad apps since the introduction of the iPad in 2010 (Mango, 2015). Mathematics teachers have been integrating interactive iPads into instruction to increase students' learning opportunities (Cumming, Strnadova, & Singh, 2014; Perry & Steck, 2015). However, studies on iPad use in classrooms using the Common Core standards-based math curriculum at higher grade levels is limited. The results of this study may provide information on iPad use in Common Core mathematics classes to improve special education students' learning experiences.

Use of iPads with autistic students has been well documented in several studies (Wishard, 2015; Vlachou & Drigas, 2017). Other studies have shown that autistic students used iPads for learning and there was improved engagement (Vlachou & Drigas, 2017). Wishard (2015) investigated teachers' perspectives regarding iPad use to accommodate the academic needs of special education students, and the results of the study showed that teachers had positive perspectives toward using iPads with children with autism. Vlachou and Drigas (2017) compared student behavior and academic performance when instruction was iPad based and when traditional methods of instruction were used for children with autism. The results showed that students had less challenging behaviors but increased academic engagement and performance when instruction was iPad based (Vlachou & Drigas, 2017). Other studies compared and contrasted iPad use to traditional pedagogical approaches in elementary school math

classes, such as first grade (Al-Mashaqbeh, 2016), and the results showed an improvement in students' academic achievement when students used iPads. However, there is still limited literature on use of math apps (Bottge et al., 2015) including at middle school level with students with MLD in math inclusion classrooms with a Common Core standards-based curriculum.

The new rigorous mathematics standards in the United States have been challenging to both special education teachers and students (Cramer & Gallo, 2017). The standards require a demonstration of depth of knowledge of math concepts (Watt et al., 2016). Federal education mandates have included closing achievement gaps between education students and regular education students (Thurlow, Wu, Lazarus, & Ysseldyke, 2016). Inclusion teachers have been challenged to be creative in pedagogy and to use technologies that would support student learning (Bottge, et al., 2015). Recently, emphasis has been on increasing support to special education students and giving them access to mainstream curricula (Al Hazmi & Ahmad, 2018). As a result, there has been increased iPad integration in K-12 curricula across the United States (Maich & Hall, 2016). Despite debates between those advocating for the use of iPads and those skeptical of their pedagogical benefits, iPad use in schools has increased (Mango, 2015). Those supporting the use of iPads cite the educational advantages of apps for educational purposes while skeptics fear the use of iPads as a substitution for instruction instead of augmenting learning (Mango, 2015). Even though technology integration such as the use of computers has been geared toward improving learning experiences, regular education students still outperform students with special needs in math assessments (Beal &

Roseblurn, 2015; Watt et al., 2016). The gap in literature was that several studies addressed the use of iPad apps in mathematics classrooms at the primary and middle school levels, but researchers had not explored the experiences of students with MLD regarding iPad app use in Common Core math inclusion classrooms. This study was needed to provide findings regarding the experiences of math app users in an inclusion classroom to provide insights about technology integration in math inclusion classrooms with students who have challenges in math learning.

Purpose of the Study

The purpose of this qualitative single case study was to identify and describe eighth-grade math inclusion teachers' and students' experiences with the use of iPad apps in a Common Core standards-based math curriculum. The results of this study provided possible recommendations for integrating iPads in the eighth-grade inclusion Common Core math curriculum to improve learning experiences of special education students in math learning and to improve pedagogical experiences of inclusion teachers. Data collected in the form direct lesson observations, document analysis, and individual teacher and student interviews on their experiences with using iPads may give insight on the benefits and challenges of using iPads with special education inclusion students. Stakeholders who might benefit from the findings of this study include inclusion teachers, special education program facilitators, special education coordinators, and technology program facilitators. The benefit may be improving technology integration in the rigorous math curriculum in middle school classrooms that service special education students.

Research Questions

The following questions guided the study:

1. What are the experiences of eighth-grade inclusion teachers with using iPads in Common Core math classes?
2. What are the experiences of eighth-grade inclusion students with math learning disabilities using iPads in Common Core math classes?

Theoretical Foundation

The experiential learning theory (Dewey, 1938) provided the theoretical foundation for this study. As a progressivist, Dewey (1938) maintained that student experiences should be the center of instruction and learning. The idea that experiential learning theory may guide teachers' decisions on pedagogical strategies that are student centered may provide insight on teachers' choices of apps. The types of apps chosen may have an effect on students' experiences with iPads. The process of choosing apps for pedagogical strategies may influence teachers' experiences. Dewey's experiential learning theory was used to understand the experiences of iPad app users in a Common Core math curriculum in inclusion classrooms.

Kolb (2014) described learning as an outcome of experience and as a process that goes through two continuums. The processing continuum identifies how learners process information, and the perception continuum identifies how learners feel about the learning task (Kolb, 2014). Kolb proposed that within the two continuums, learners go through stages of learning. Educators should provide learning experiences designed to offer engagement opportunities to learners to suit their learning styles. Learning experiences

should be designed to draw on abilities from each stage of the experiential learning cycle. Investigating the impact of using iPad math apps in classrooms with students with MLD may shed some light on how to effectively integrate technology to provide opportunities for learning to diverse learners. Findings may also be useful in making recommendations to stakeholders. A more detailed analysis of the influence of theory and technology integration conceptual framework is presented in Chapter 2.

Conceptual Framework

The concept of technology integration guided this study. The main concept threading through related literature is technology integration and iPad use. Technology integration involves the interplay of the three components of the learning environment: instructional strategies, technology, and subject matter teacher expertise (Koehler, Mishra, Kereluik, Shin, & Graham, 2014).

The technological pedagogical content knowledge (TPACK) model (Koehler et al., 2014) and the universal design for learning (Hall et al., 2015) explained the concept of technology integration and guided this study. The TPACK model (see Figure 1) informed this study in understanding teachers' choices of iPad apps for technology integration. The model also informed this study in that it helped to initiate discussions with teachers about their experiences with using iPads (Smith & Santori, 2015). The TPACK model and the universal design for learning (UDL) model focus on curriculum development to explain how to provide learners with effective learning experiences. The UDL framework helped in understanding the technological accommodations for special education students.

The focus of the UDL is on how instruction is designed and how this helps educators understand how technology can improve learning experiences through increasing access to learning (Cook & Rao, 2018). The UDL provides the lens that guides instruction to provide equal learning opportunities to every student (Hall et al., 2015). The UDL improves the learning experience of all students by providing a variety of ways of representing knowledge to engage learners and by providing individual choice of demonstrating learning (Fisher & Frey, 2017). The UDL is a representation of 21st century intervention in which the goal is to use knowledge from various fields including instructional design and technology. Cook and Rao (2018) described the UDL as guidelines in the provision of scaffolds and flexible options to reduce barriers and ensure access for all learners. Technology is the backbone to implementing a UDL instructional design (Fisher & Frey, 2017). Learning environments and pedagogical strategies must provide multiple ways for recognition to cater to diverse learning styles of students (Fisher & Frey, 2017). A universally designed lesson provides multiple means of expression and action.

The TPACK model highlights the necessary teacher qualities for technology integration. According to the model, technology integration teacher knowledge is multifaceted, complex, and situated (Koehler et al., 2014). Teachers must be knowledgeable in the subject content and in technology use for that content.

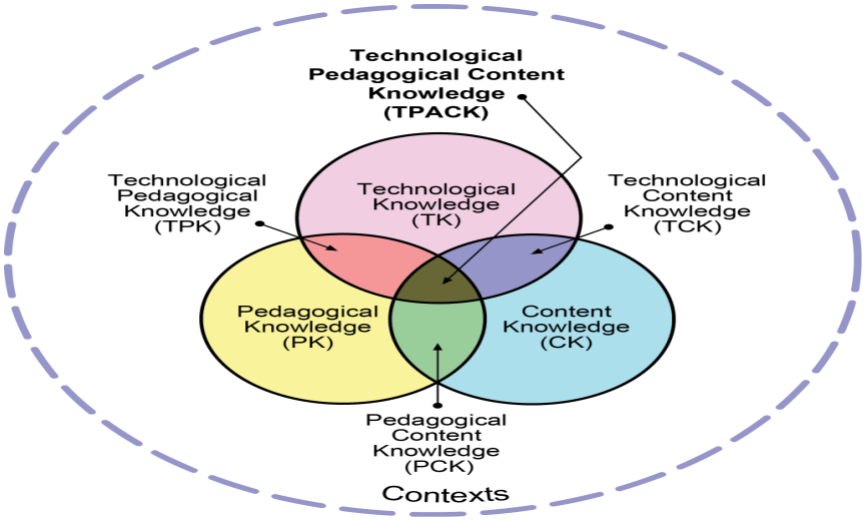

Figure 1: The TPACK model. Reproduced with the publisher's permission, copyright 2012 by tpack.org.

The TPACK model identifies three kinds of knowledge that a teacher needs to have: pedagogical, content, and technological.

The TPACK model embodies the concept of technology integration into the curriculum. Not only are teachers required to have content and pedagogical skills, they are also required to have technology knowledge to integrate technology into pedagogy. Content knowledge defines teachers' knowledge of subjects taught while pedagogical knowledge defines the methods of teaching and learning. Technology knowledge defines understanding how integrating technology supports content comprehension (Rosenberg & Koehler, 2015).

The way iPads influence pedagogical experiences was central to this study. In this study, the TPACK and the UDL model informed Research Questions 1 and 2. The increase in inclusion students in Common Core classes accompanied by accommodations for their learning, such as use of assistive technology including computers and iPads, has

partly influenced by technology integration in pedagogy. Teachers need innovative supports to accommodate the needs of all students (Hall et al., 2015). The iPad is a technological support to the teachers' pedagogical approach to the curriculum (McMahon, 2014). The experiences that teachers and students have using iPads informed Research Questions 1 and 2.

The conceptual framework of technology integration for effective instruction guided several studies (Ok & Bryant, 2016). An increase in new technologies at affordable costs explains a rise in technology integration in mathematics classrooms (Bryant et al., 2015). In Chapter 2, I present a detailed analysis of the influence of theory and the conceptual framework.

Nature of the Study

The purpose of this qualitative single case study was to identify and describe eighth-grade math inclusion teachers' and students' experiences with the use of iPad apps in a Common Core standards-based math curriculum. A qualitative case study was appropriate for this study because it allowed for an interpretative approach to data collected to generate themes (see Creswell & Poth, 2017) about the experiences of iPad app users in math inclusion classrooms. A single case study was appropriate for this study because it allowed for extensive collection of data using various tools and an in-depth analysis of the data (see Creswell & Poth, 2017). A qualitative single case study allowed me to collect data through individual teacher and student interviews, teacher lesson plans, student work samples, and direct lesson observations (see Creswell & Poth, 2017) of iPad app use in two eighth-grade math inclusion classes in a middle school

setting. To analyze data, I used cluster codes and categories (see Alase, 2017) created by grouping teachers' and students' experiences that carried the same meaning, and I used an interpretative approach to identify emerging themes.

Definitions

Assistive technology: Devices and services (Ahmed, 2018; Cook & Rao, 2018; Erdem, 2017) that a child with disability can use to improve his or her learning experiences and to complete learning tasks. Assistive technology is one way that helps students cope with disabilities that hinder access to learning materials. Research has provided evidence to support the pedagogical use of iPads to influence learning experiences of students with special needs (Cumming et al., 2014). Assistive technology is any equipment, electronic or other, that enables special education students to achieve their learning goals (Ahmed, 2018; Erdem, 2017).

California Common Core math standards: Standards that are linked within and across grades. In the California Common Core standards, there are two types of math standards including the eight mathematical practice standards and the content standards. The eight mathematical practice standards are similar for all grade levels and are geared to develop habits of the mind. The content standards are different between grade levels but have a vertical alignment in that standards at lower grade levels support standards in the next grade levels. The standards for K-8 prepare students for higher mathematics at senior high school (Hernandez, 2018). In this study, I collected data from Sundance Middle School (pseudonym) with eighth grade math inclusion classes to explore iPad use in word problems for the Common Core curriculum.

Inclusion: Mainstreaming special education students. Goransson and Nilholm (2014) defined inclusion as mainstreaming special education students to meet their social and academic needs. This definition implies that placement of special education students in a general education setting is socially and academically beneficial for students with special needs including those with MLD.

iPad: A touch screen device with a special pen and capacity to be loaded with applications that can be beneficial for student learning (Al-Mashaqbeh, 2016).

Math learning disabilities (MLD): A lack of mathematical skills due to some processing disorder resulting in low mathematical performance. Swanson, Olide, and Kong (2018) defined students with MLD as those whose performance in a norm referenced test falls between the 11th and 25th percentile.

Special education or special needs: A condition of being either physically or mentally challenged. One of the categories of special education is a specific learning disability that refers to a disorder in psychological processes necessary for learning comprehension (Exceptional Students and Disability Information, n.d.). In this study, inclusion special education students and students with special needs are used interchangeably as descriptive terms for inclusion learners with an IEP math goal and difficulties in learning math concepts.

Technology: Electronic devices such as iPads used as a tool for learning. Erdem (2017) defined assistive technology as technology in special education including any form of equipment and changes made to the environment to enable student access to

services. In this study, technology referred to devices such as an iPad that has all computer applications (see Al-Mashaqbeh, 2016).

Universal design for learning: A pedagogical model that help teachers create learning environments to accommodate students' learning needs. The UDL defines assistive technology as devices that enable access to the Common Core standards (Cook & Rao, 2018; Fuchs et al., 2015; Rao, Ok, & Bryant, 2016).

Assumptions

The assumption was that participants attended school regularly, and attendance did not influence the exposure to use of iPads for math learning. Absence of participants may have influenced data collected when observations were done during their absence. Poor attendance might have impacted student experiences with using iPads for learning. Another assumption was that the classes involved in the study were not going to experience student transfers during the study period. If participating students transferred out of the school or class that was being observed, the number of student participants might have been reduced. I also assumed that interviewees were truthful in their responses. Accurate responses influence data analysis and determine the results, discussions, and recommendations for future research and iPad use.

Another assumption was that students would exert maximum effort when learning with iPads. Student effort while using iPads may determine how students experience using the iPads for math learning. Fluidity of classes can influence what knowledge the students bring into a new class. In a school in which students move between classes based on their performance, participants' experiences with using iPads might be influenced by

factors other than those observed within the classroom. Prior exposure to use of iPads in a math class math might have influenced students' experiences with use of iPad math apps in a Common Core standards-based curriculum.

Scope and Delimitations

The focus in the study was to inform stakeholders about the experiences of special education inclusion students with challenges in math learning and inclusion teachers who used iPads for the rigorous math curriculum. The shift to inclusion and use of the Common Core standards have posed pedagogical challenges that have resulted in inclusion students trailing their counterparts in math achievement (Schulte & Stevens, 2015). Inclusion is aimed at making the regular education curriculum accessible to all students including special education students (Ahmed, 2018). However, academic achievement data showed that inclusion special education students have continued to have low scores (Tan & Kastberg, 2017).

In this study, student participants were inclusion students excluding those who had disabilities other than MLD. The single case study was of a school with two inclusion math classes in which iPads were used. The participants were one special education teacher, eight special education students, and one regular education inclusion math teacher. This study was confined to data collected during a 3-week period to reduce the impact of newly identified special education students and those no longer in need of services. In the 3-week study, I collected data using individual student interviews, teacher interviews, and direct observations. Student participants included a stratified random sample to create a sample that was representative of all special education students so that

findings could be transferrable. Two inclusion teachers were a representative sample of middle school math inclusion teachers. Findings from teacher participants can be used to make generalizations about the experiences of junior high school math inclusion teachers because a small sample of teacher participants enables in-depth collection and analysis of data. However, because schools differ in the way they implement technology, findings from one school may not be generalized to every other middle school math inclusion classes.

Limitations

There was a small participant pool from eighth-grade classes. The study involved eighth-grade inclusion students using iPads for the Common Core math curriculum. The study was limited to two classes that use iPads in eighth grade at the middle school level and was limited to students with MLD. The results might not be transferable to all inclusion students. Multiple disabilities can influence learning experiences. Also, teacher expertise with using iPad math apps can be a factor.

The study was conducted over 3 weeks, and this time might not have been enough to develop a thorough understanding of how iPads influence teachers' and students' experiences over an extended period. There was also no guarantee that participants would remain the same class because there was no control over students entering and exiting special education programs. Also, I could not control supports that special education students received through their accommodations and modifications in their individualized education plans. Variations in accommodations and modifications for different students may have contributed to the different responses given by student participants.

The results of the study from such a setting might not be transferable to other inclusion math classes. The study was limited to students with MLD and to two inclusion teachers. There are several disabilities that can influence experiences with Common Core math standards while using iPads. Also, teacher experience and skill with using iPads may have influenced the outcomes. The study was also limited to a single school that was conveniently selected. Such a selection may cause a bias to a particular class with more experience of using iPads. The results of the study may not be transferable to other inclusion classes in other schools. To address bias that might have arisen from convenience sampling, invitation letters were sent to the first school that was randomly chosen from the list of potential school sites.

Significance

Several researchers explored the use of iPads in K-12 classroom settings investigating engagement, motivation, literacy, academic achievement, or teachers' beliefs about using iPads for pedagogical purposes (Flewitt et al., 2014; Karlsudd, 2014). However, literature on the experiences of iPad math app users is limited. An investigation of students with special needs' experiences with using iPads during math learning may add to learning theories. Findings may also add to the UDL concept and may inform stakeholders on how technology such as iPads influences learning in inclusion math classes.

The results of the study may influence instruction and learning by providing recommendations on integrating iPad use in eighth-grade Common Core math classes. Mathematics instruction provides valuable skills used in everyday life making it

imperative to equip all students with these skills necessary for use in school and employment settings. Although mathematics skill deficits influence students' ability to pass higher math classes needed to graduate, there has been limited research in this area (Swanson et al., 2018). Common Core standards require use of technology to influence student learning experiences. The study may contribute to use of technologies like iPads to improve learning of special education inclusion students. Findings may suggest ways of servicing special education students in inclusion settings.

Significance to Practice

The results of the study may influence instruction and learning of inclusion students with MLD by providing recommendations on integrating iPad use in Common Core math inclusion classes. For a long time, technology has been in the hands of teachers, but with increased use of iPads, more students, including those with learning disabilities, are using technology for learning (Mango, 2015). Investigating the experiences of special education students with the use of iPad math apps can inform inclusion accommodation practices. Investigating teacher experiences with using iPads in inclusion math classes may inform teaching practice in technology integration to improve learning experiences for special education students. One of the Common Core requirements is integrating technology to improve student learning experiences. The study may contribute to using assistive technology to improve student experiences in math learning.

Significance to Theory

An investigation of the use of iPads in math learning added to theories of learning. The study included UDL concepts in iPad use for math learning. This added to the UDL concept of technology integration by informing stakeholders on how iPads influence learning in inclusion math classes. The results of the study also added knowledge on how teachers choose technologies for instruction and learning. Findings added to the understanding of the TPACK model that guides technology integration.

Significance to Social Change

Mathematics instruction provides valuable skills used in everyday life making it imperative to equip all students with these skills necessary for use in school and after school. Although mathematical skill deficits affect students' high school graduation, little attention has been paid to research in this area (Swanson et al., 2018). Findings may provide insights on ways of servicing special needs students with challenges in math learning in inclusion settings.

Summary

Educators have been concerned about special education students' performance in math (Schulte & Stevens, 2015). Mainstreaming special education students is intended to close gaps in learning by making the general curriculum available to special education students. However, mainstreamed students continue to have lower achievements scores compared to their counterparts and score below average in math tests of achievement and standardized tests (Tan & Kastberg, 2017). The Common Core standards and the push for UDL are placing pressure on educators to increase the conceptual understanding of math

by all students, to use real-life experiences as presented through word problems in math, and to integrate technology to create innovative learning environments for all students. Few studies have addressed iPad math app use in middle school.

Investigating the experiences of iPad users in inclusion math classrooms may add to insights on the challenges that other educators may encounter when integrating technology Common Core math classes at the middle school level. Findings may also add to insights on the challenges that inclusion students may encounter using technology in the Common Core math curriculum. In Chapter 2, I review literature relevant to concepts pertaining to the problem statement.

Chapter 2: Literature Review

This qualitative single case study was designed to investigate the experiences of iPad users in an eighth-grade Common Core math inclusion class. To understand how technology such as iPads influences 21st century classrooms including those with special education students, literature addressing how iPads are used in different education settings, use of iPads at different school settings, and several constructs related to technology in the classroom was reviewed. Even though technologies such as the computers have been used in special education for quite some time, special education students continue to score lower than their regular education counterparts in math assessments (O'Malley et al., 2014). However, literature addressing use of iPads at higher grade levels is limited (Anderson et al., 2017; Wishard, 2015).

The rigorous nature of the new math standards demands that teachers should integrate technology to support student learning (Bottge et al., 2015). Recent education policy requires pedagogy that is grounded in research-based strategies including using technology. Technology is a tool that can change pedagogical practices to accommodate students' learning needs (National Technology Plan, 2016). Persada, Miraja, and Nadlifatin (2019) described the 21st century learners as digital natives. Scholars acknowledged the need for an educational approach that is learner centered and includes technology-rich environments and applications. Anderson et al. (2017) maintained that technology has become a crucial element for the educational needs of students. Education settings including K-12 have shown an increase in iPad use (Anderson et al., 2017;

Harrison & Lee, 2018; Maich & Hall, 2016). The choice of technology and how it is used in the curriculum is crucial in determining student learning experiences (Hilton, 2018).

Chapter 2 offers an exploration of the relationship between the research questions and the literature. An exhaustive search yielded articles on iPad use in different education settings. Literature that addressed use of iPads in classrooms with students with learning disabilities, particularly MLD, is reviewed. This chapter includes information on the (a) literature search, (b) theoretical foundation, (c) conceptual framework, (d) literature related to technology integration, (e) technology standards in the United States, (f) math learning disabilities, (g) technology and special education, (h) iPad, (i) benefits of iPads, (j) challenges of using iPads, (k) use of iPads at elementary schools, (l) use of iPads at middle schools, (m) iPad use in high schools, (n) teacher perspectives on using iPads, and (o) student perspectives on using iPads.

Literature Search Strategy

I used the Walden University library to search databases including American Doctoral Dissertations, Academic Search Premier, Education Source, and ERIC. Broad search terms such as *iPads and learning*, *iPads and math*, *iPads and special education*, *iPads and inclusion*, *iPads and elementary school*, *iPads and middle school and technology integration*, *technology standards in the U.S.*, *assistive technology*, *technology and math*, *technology theories*, *technology and learning*, *math learning disabilities*, *teacher perceptions and iPads*, and *student perceptions and iPads* were used to search for relevant literature. Journals reviewed for relevant articles included *Journal of Information Technology Education*, *Journal of Education Technology Development &*

Exchange, Journal of Intellectual Disability Research, *Contemporary Issues in Technology & Teacher Education*, *MACUL Journal*, *Teaching Exceptional Children*, and the *International Journal of Special Education*. For academic rigor, all articles were peer reviewed.

The initial attempt to find articles using search terms such as *iPads and mathematics and inclusion* yielded limited articles. It was necessary to vary the search terms to include *learning and technology integration*, *assistive technology and special education,* and *technology and math*. Broader search terms such as *iPads and math* were narrowed to *iPads and elementary school*, *iPads and middle school*, and *iPads and high school*. Narrowing parameters yielded several relevant peer-reviewed articles.

Theoretical Foundation

Dewey's (1938) experiential learning theory provided the theoretical lens for this study and helped to explain individual experiences as the main factor influencing student learning. Experience causes learning in that students connect prior learned knowledge to current content learning by using the experiences they have with the outcome of what they do to learn material (Dewey, 1938). Dewey's philosophy of education was progressive through promotion of experiential learning, an approach that is learner centered. This learning theory was the ideal lens through which to explore the experiences of teachers and students with iPads in math inclusion classes. The experiential learning theory contributed to the understanding of the outcomes of the research. Teachers chose apps that influenced the learning experiences of students. Student learning experiences with the iPads influenced prior knowledge connection in

subsequent learning activities. The experiences with iPad use also influenced student motivation and engagement and impacted their academic performance.

Dewey's progressivist experiential learning theory focuses on students' needs. According to Carr (2012), learning experiences must be student centered, relevant, and flexible to accommodate students' needs. The backward and forward connections that students make as a result of the immediate feedback they get from a learning activity foster student acquisition of knowledge and empower students to have participatory roles in the learning process. This aspect of the theory addressed the research question on student experiences with iPads. The student-centered theory influences 21st century innovation and change in education settings. This implies that student academic achievement may be influenced by experiences with iPads. Dewey's experiential learning is supported by progressivists who advocate for student-centered pedagogy (Carr, 2012). Experiential learning contrasts with essentialists' philosophy such as Locke's blank slate (Carr, 2012) that proposed that teachers should deposit knowledge into students' empty brains. Dewey's experiential learning theory proposes that students acquire knowledge because they make connections with what is previously learned through individual experiences. Carr used Dewey's experiential learning theory as a lens for his study on iPads and student achievement, and the findings indicated that students using iPads demonstrated increased academic achievement.

Conceptual Framework

The universal design for learning, the TPACK framework, was the technology integration conceptual framework that guided this study. In the 21st century classroom,

technology integration is an essential tool for effective instruction, and its integration in mathematics instruction has been affirmed (OK & Bryant, 2016). Although there is numerous evidence supporting the incorporation of technology in the curriculum (Carr, 2012), the iPad has become increasingly used. Educational apps seem to be effective learning tools for special education students (Bryant et al., 2015). Smith and Santori (2015) stated that as iPads become increasingly used for technology integration in pedagogy, teachers are challenged by how to effectively incorporate such technologies into the curriculum.

Technologies such as iPads have many ways in which they encompass the principles of UDL (McMahon, 2014). The three UDL principles of instruction guide educators into providing students with several ways of demonstrating knowledge, several ways of learning, and several avenues for engagement (McMahon, 2014). The UDL also provided the framework that guided the research questions addressing the experiences of iPad math app users in eighth-grade inclusion classrooms to inform future implementation. The UDL is instructional design that creates conducive learning environments for learners (Hall et al., 2015).

Salend and Whittaker (2017) defined UDL as differentiating pedagogy. This means differentiation in the presentation of content (multiple means of representation), allowing learners to show their learning, and using differentiated instruction to trigger student motivation (Salend & Whittaker, 2017). The principles of differentiated instruction provide a variety of learning opportunities for students with varying learning

needs (Rao, Smith, & Lowrey, 2017). Technology integration is crucial in the implementation of UDL to facilitate accessibility (Bicehouse & Faieta, 2017).

Wang, Hsu, Reeves, and Coster (2014) maintained that digital technologies can aide learning in different content areas. However, despite digital technologies evolving constantly and providing instructional opportunities for students, many teachers are either not using technology or are not receiving professional development in many states across the United States (Pepe, 2016). Integrating technology as a substitute for the traditional teaching strategies is not an effective means of giving access to the curriculum to all students (Hilton, 2018; Hutchison & Colwell, 2016). Integration of technology must be well planned to facilitate student achievement of academic goals (Howard, 2017). The TPACK framework helped in understanding selection of apps for math instruction and learning in the Common Core math inclusion classes.

Assistive technology includes tools and devices that a student with disability can use to improve his or her learning experiences (Ok, 2018; Erdem, 2017). Technology for special education has been defined to include handheld devices. Much research on the iPad as assistive technology in education settings has been conducted (Ahmed, 2018; Wishard, 2015), but there is limited research on how iPads can be integrated for math instruction and learning in math classes with special education students (Zhang et al., 2015) to access the new Common Core standards. Research has shown that computer-based instruction can be vital in supporting students with learning disabilities (Ok & Kim, 2017). As iPads have become more popular, they have gained increasing use in the education field even though research on their use in many education settings is limited

(Connor & Beard, 2015; Ok & Bryant, 2016). The iPad has apps for math interventions with special education students (Al-Mashaqbeh, 2016). An understanding of the experiences of iPad users in math classes may help inform other educators on using iPads or technology integration for the rigorous math curriculum in inclusion classes, and the challenges faced during implementation.

Literature Review Related to Key Variables and/or Concepts

Federal legislation requires schools to account for academic progress of all students (Cook & Rao, 2018). The introduction of the rigorous math standards, referred to as the Common Core standards, has increased instructional recommendations for special education students with a focus on inclusionary practices. Much of the Common Core math standards assessments involve word problems. Bottge et al. (2015) maintained that students with learning difficulties in math struggle with comprehending word problems. To scaffold learning and to enable students to have a visual picture of the abstract concepts in word problems, Bottge et al. used interactive tools and added computer-based modules to increase student learning. As a result, in line with the concept of technology integration in UDL, the problems were represented in multiple ways. The findings of the study demonstrated that a blend of direct instruction and anchored instruction with electronic devices such as computers can improve students' mastery of math concepts in the Common Core state standards (Bottge et al., 2015). Mastery of math concepts is a concern for researchers in special education. The challenge is for teachers to constantly look for innovative strategies, supports, and tools to provide learning supports for the educational needs of all students (Hall et al., 2015). Subsequently, iPad-use in

classrooms is becoming prevalent. Wishard (2015) maintained that the iPad is a new tool for classroom computing and has many functions. Several researchers have underscored the benefits of incorporating iPads into the curriculum (Al-Mashaqbeh, 2016; Anderson et al., 2017; Beal & Rosenblum, 2015).

Literature reviewed included studies on factors influencing the integration of technology for pedagogical purposes but there is scarcity of literature on the experiences of the technology users in Common Core standards-based math curriculum. Kaczorowski, Hashey, and Di Cesare (2019) explored the impact of supporting student learning in math using multimedia. The researchers used the Universal Design for Learning framework to decrease learning barriers while taking advantage of students' strengths to help them reach their optimal learning capacities. The results of the study suggested that all could benefit from use of multimedia in improving math learning experiences. Several researchers investigated children's experiences with iPads (Alzrayer, Banda, & Koul, 2014; Carr, 2012; Domingo, & Gargante, 2016; Smith & Santori, 2015; Wang, 2017). Alzrayer et al. (2014) maintained that due to an increase in new technologies, more research on the use of the new devices is necessary. Alzrayer et al. (2014) studied iPad-use and its impact on special education students' communication skills. The results were that iPad-use increased the communication skills of the participants. Also, there was a decrease on the behaviors of the participants who had exhibited aggressive behaviors prior to the study. Domingo and Gargante (2016) investigated the impact of technology-use in elementary school level pedagogy. Teacher's notions about use of iPad apps influenced the choice of apps. Domingo and

Gargante (2016) maintained the choice of apps influenced learning and improved some aspects of learning. These findings could give educators insight on use of apps to improve students' learning experiences.

Research points to the advantages of iPad-supported pedagogy. Pitchford & Kamchedzera (2018) asserted that math apps are interactive and possibly support learning of basic math skills. Persada et al. (2019) describe students who are currently in high school and some who are in college as Generation Z or the digital natives. Therefore, 21st century students expect to use of electronic devices in the curricula. Many educators have positive perceptions about the potential of using mobile learning devices. Liu et al. (2016) investigated teacher comfort level and perceptions about use of iPads for instruction and the results were that teacher with lesser experience in the teaching field had a more positive attitude towards and higher comfort level of using iPads than teachers with over twenty years of teaching experience. High school teachers were found to have the lowest perception and comfort levels in using iPads. However, literature does not elaborate on how the rewards of integrating iPads in the curriculum might be realized (Smith & Santori, 2015). Few researchers investigate math interventions for special education students in inclusion classrooms. As iPad-use as an aide to learning and instruction in mainstream pedagogy increases, educators struggle with envisioning how to effectively incorporate the technology into the curriculum (Harrison & Lee, 2018). Minshew and Anderson (2015), maintained that the concern is that educators are expected to use technologies including iPads in the classroom when related research is limited and where research provides no clear evidence that iPads integration in the

curriculum improves learning. Bottge et al. (2015) investigated the impact of anchored instruction involving computer-based activities in inclusive classrooms. Students who used computer-based activities improved their performance on math skills. However, research shows that there is still limited literature exploring iPads at higher grade levels (Wishard, 2015) including inclusion 8th grade classes.

Math Learning Disabilities

The term math learning disabilities (MLD) refers to disability in mathematical cognition resulting in low academic performances (Swanson et al., 2018). Students with MLD are challenged by working memory and struggle to retain information during instruction when they are required to continually process information input (Swanson et al., 2018). There are three types of math learning disabilities including deficits in procedural knowledge, visiospatial, and semantic memory deficits (Harris & Graham, 2019). Students with procedural deficits are challenged by number sense and mathematical concepts (Harris & Graham, 2019). Semantic memory deficits define neural conditions that affect student ability to retrieve math facts that would enable them to solve word problems. Students with semantic memory deficits are challenged by the ability to manipulate and represent information presented in word problems (Harris & Graham, 2019; Swanson et al., 2018). Visiospatial difficulties are challenges in geometry and complex word problems (Harris & Graham, 2019).

Since mainstreaming students with special needs in math has become prevalent, educators have to be knowledgeable about working with such students. While mainstreamed students with MLD have procedural, semantic memory, and visual deficits,

Common Core Standards continue to emphasize problem solving and conceptual understanding skills (Harris & Graham, 2019). On the other hand, middle school teachers have high expectations for all students including mastery of basic math skills such as conceptual knowledge of numbers and procedural knowledge that are prerequisites for higher level mathematics (Harris & Graham, 2019). Effective teaching and learning strategies are therefore crucial in inclusion classroom with students with MLDs. Knowledge about the types of MLDs helps in making instructional decisions including technology integration.

Technology Integration

The emphasis on technology integration in the curriculum is the effectiveness of using it for education purposes and recognizes the value of leveraging it to enhance student engagement in learning activities and to make learning materials easily accessible. The value of technology integration in pedagogy has received widespread endorsement and has been lauded for its benefits in different education settings (Ok & Bryant, 2016). The emphasis is on the value of technology as a factor influencing teaching and learning mathematics (Ok & Bryant, 2016). However, even though special education students have been using technology including the computer, they still score lower than their general education counterparts in curriculum assessments (Beal & Roseblurn, 2015).

The benefits of education technology have been seen to include their great potential in improving mathematics achievement (Schuetz et al., 2018). Several studies emphasize the value of technology in promoting student engagement, learning, and

mathematics achievement (Carr, 2012; Stevens, 2011; Schuetz et al., 2018; Zhang et al., 2015). With the prevalence of iPad-use both outside and in school settings, mathematics teachers have been integrating technology in the form of iPads to improve the learning process (Perry & Steck, 2015). Stultz (2017) maintained that the decline in the costs of technological devices and the federal education policies account for increased technology integration in K-12 settings. Therefore, the use of the tablet has increased in different classroom settings including inclusion classes (Maich & Hall, 2016). However, classroom-based research on iPad-use for instruction and learning is just emerging (Maich & Hall, 2016).

The Common Core Standards not only require deeper conceptual knowledge and use of real-life experiences but also require educators to leverage technology-use as a learning tool. For a long time, technology integration meant technology in the hands of the educator as a teaching tool. Few studies examined technology integration particularly in math inclusion classes where learning activities are learner-centered (Hilton, 2018). However, use of iPads in the classrooms has increased despite limited research-based evidence to support the incorporation of iPads in the curriculum (Mango, 2015; Retalis et al., 2018).

The new generation of learners has been referred to in different ways because of their characteristic constant use of technology. The term digital kid refers to students that use traditional media, use web-based information, and play electronic games (Cosmah & Saine, 2013). Persada et al. (2019) refer to such as students as Generation Z or the digital natives. Millennials refers to 21st century learners growing up in the electronic or digital

world while Net Generation refers to Internet users and how it impacts their lives (Cosmah & Saine, 2013). Common Core Math Standards pressure teachers to incorporate technology into the curriculum for students attain digitally literacy (Cosmah & Saine, 2013). The implication is that technology use in pedagogy should be pivotal in efficiently supporting students' learning including in mathematics. As integration of technology has, in recent years, become a growing trend (Soffer & Yaron, 2017), the question is how educators leverage technology in inclusion classrooms. Use of tablets has potential contribution to learning (Soffer & Yaron, 2017). Research-based evidence for iPad-use in the classroom is relatively new and educators may still be struggling technical know-how (Maich & Hall, 2016). Research on integrating iPads into the learning environments for special education students is still in its infancy (O'Malley et al., 2014). Hutchison and Colwell (2016) maintained that technology integration in and of itself is meaningless. Educators must integrate technology to effectively facilitate student achievement of academic goals (Anderson et al., 2017).

Technology Standards

Technology standards provide the framework for using technology in the classroom (Cosmah & Saine, 2013). The performance indicators for educators to demonstrate mastery implementation of the technology standards include (a) using technology to boost student learning (b) ability of teachers to design learning environments that utilize technology for pedagogical purposes including student learning and assessment (c) teachers to demonstrate ability to use new technologies (d) educators to promote student ability to responsibly to use technology in a global context and (e)

teachers to continue improving their technology skills through professional development (Cosmah & Saine, 2013). To improve student-learning experiences, teachers tap into their technology knowledge, teaching skills, and subject matter knowledge (Anderson et al., 2017).

Even though research has indicated that incorporating technology into the curriculum can foster engagement in learning, improve academic achievement, and avail opportunities to create authentic pedagogical experiences (Carr, 2012), on its own technology does not determine a successful integration but how the technology is integrated is crucial (Anderson et al., 2017; McKnight et al., 2016). Research has provided evidence that use of digital technologies support learning (Kaur, Koval, & Chaney, 2017). Some teachers are still skeptical about using iPads (Mango, 2015). Studies on using the iPad over other technologies in different classroom settings and with different types of students have yet to show its significant and consistent benefit. As iPad-use in educational settings increases, educators can learn from the experiences of other iPad-users (Maich & Hall, 2016).

The 21st century education landscape is characterized by emergent technologies such as the tablet computer that is added to the daily classroom (Ditzler, Hong, & Strudler, 2016). Research has pointed to the benefits of using technologies such as iPads but very few studies show how iPads can be used to realize those benefits (Smith & Santori, 2015). Despite the widespread integration of iPads in the curriculum (Mango, 2015), educators are challenged by how to effectively utilize them (Smith & Santori, 2015). In some studies, there results showed that in some cases teachers did not

effectively use iPads (Ditzler et al., 2016). An effective integration of technology for pedagogical purposes is a result of how the technology is integrated. Understanding users' experiences with iPads for the rigorous mathematics standards is important for effective implementation of using iPads in any setting (Ditzler et al., 2016). Investigating the experiences of teachers and students using iPads for math in an inclusion classroom may inform effective integration of such technologies in the curriculum.

Technology in Special Education

The increase in the number of special education learners in mainstream classrooms at middle school level poses a challenge to educators (Woodcock & Hardy, 2017). The challenge is that educators must provide conducive learning opportunities to facilitate student learning and improve their learning experiences. However, there is inadequate teacher preparation to service inclusion special education students (Woodcock & Hardy, 2017). Subsequently, teachers are searching for ways to effectively educate special education students in inclusion settings. Erdem (2017) defined assistive technology as any tool, equipment, and changes made to support individuals with disabilities. Several studies have shown that assistive technology is effective in supporting student learning (Cumming et al., 2014). There is sufficient research base supporting technology for special education students (Cumming et al., 2014). However, over time assistive technology in special education has changed (Erdem, 2017) but studies on special education students using assistive technologies such as iPads in math classrooms are limited.

IDEA (2004) mandates that the Individual Education Program (IEP) team members consider assistive technology and consider the principles of UDL when developing students IEPs ((Etscheidt, 2016). Assistive technology and the principles of UDL support student learning needs by relying on technology (Erdem, 2017). Assistive technology is specific to an individual student but Universal Learning Design targets all students during curriculum design. Assistive technologies assist students with special needs to access education through adapted content and curricula activities. Ederm (2017) maintained that assistive technologies facilitate improved the functioning of students. Use of iPads as assistive technology in special education has increased.

The iPad

The iPad with abundant apps has been lauded as assistive technology breakthrough for special education students. The TPACK model is a guide in integrating technology in pedagogy and highlights teacher skills necessary for effective use of technology. I investigated the experiences of inclusion co-teachers and the experiences of inclusion special needs students using iPads as assistive technology for Common Core math. The iPad has gained popularity as a 21st century pedagogical technology in general education classrooms with special education students (Maich & Hall, 2016). Chandler and Tsukayama (2014) maintained that there was an increase of 60% of worldwide spending for classroom. Within three years of iPad launching, American educational institutions bought three million iPads (Smith & Santori, 2015). With an increase of iPad-use in education settings, educators are using them for instruction (Smith & Santori, 2015) in many instances without direction on how to integrate them.

Benefits of iPads

Hand-held devices like tablets are becoming common in the everyday lives of the majority of the population (Grant et al., 2015). Baker et al. (2018) maintained that even though mathematics apps are becoming frequently used in the classrooms, there is limited research on their effects on learning. Research points to several benefits of iPad-use in pedagogy (Smith & Santori, 2015) but there is limited description on how these benefits might be realized. Use of mobile learning using apps has been described as ideal for learning performance (Smith & Santori, 2015). Baker et al. (2018) maintained that digital math apps can provide positive math learning experiences. However, research investigating math apps and their effectiveness for use with special education students is limited (Baker et al., 2018) and stakeholders have limited understanding of how educators use iPads in the classroom (Liu et al., 2016). Although technology integration in the curriculum has increased, the teacher still plays an important role for its effective use. Shanley, Strandcary, Clarke, Guerreiro, and Their (2017), investigated teachers experiences with using instruction technology and their students' use of technology. The results of the study were that there was a correlation between the experiences of teachers with technology and the increased students' length of time using iPads.

The advantages of using iPads for instruction and learning include the educational apps and accessibility built-in features like the touch screen (Smith & Santori, 2015). Baker et al. (2018) used neuroscience to explore the effects of math apps on learners' brain activity. Findings were that there was increased brain activity when students used math apps for learning. Bryant et al. (2015) researched the effects of using apps for

instruction and student perspectives on using multiplication facts apps. The findings included increased student engagement in learning activities and student perceptions were that use of iPads for learning was enjoyable. This corroborated the finding that classes became enjoyable when students used tablet computers (Aksu, 2014). Apps engage students in math learning (Zhang et al., 2015) and work as instructional modules hence allow teachers to individualize the curriculum to accommodate student learning needs (Al-Mashaqbeh, 2016).

Another way in which apps promote differentiated learning is that most apps allow for self- selected differentiation because the games on apps offer choices on levels of difficulty at the start of the game (Ciampa, 2014). Use of apps support a self-paced student learning environment. The downside of using apps is that many math apps largely promote low order thinking contrary to deeper learning promulgated by the California Common Core Math Standards (Ditzler et al., 2016). Observing how iPad-use in different classroom settings demonstrates the Universal Design for Learning that emphasizes students expressing themselves in different ways, would inform future users on the choice of apps for use in Common Core math classes.

Al-Mashaqbeh, (2016) summarized the benefits of using iPads as including the ability of students to manipulate content hence appealing to the kinesthetic learner. Al-Mashaqbeh (2016) state that in math the benefits include making math classes enjoyable to students because of the visuals and animations that can be used in math learning resulting in deeper understanding of concepts. Del Moral-Perez, Fernandez-Garcia, &

Guzman-Duque (2015) corroborated kinesthetic benefit of using iPads by maintaining that use of video games appeal to the kinesthetic intelligence of students.

Despite an increase in using iPads for learning in inclusive classrooms and the associated benefits, there are challenges to the implementation (Maich & Hall, 2016; Perry & Steck, 2015). There is an increased use of the iPad as assistive technology in education settings (Maich & Hall, 2016) but without proper training, teachers are challenged by implementation. Some of the challenges expressed by teachers included the cost of the apps, time to teach iPad management in the classroom, and apps that do not adequately match with the curriculum (Perry & Steck, 2015).

IPad Use in Elementary School

Satsangi, Hammer, and Hogan (2018) posited that the academic achievement of special education students has increasingly become important. One of the expectations for educators is to raise math skill levels of students including special education students at all grade levels because basic mathematical skills of special education students impact development in advanced math concept-skills (Ok & Bryant, 2016). Basic math skills development is the main focus for elementary school (Ok & Bryant, 2016). However, special education students are not only challenged by higher grade level math courses but with other math requirements for college and employment (Ok & Bryant, 2016).

Research has shown that computer-enhanced math intervention is effective for students (Liu et al., 2016), but little evidence is available for effective use of math apps. Zhang et al. (2015) explored the use of iPad math apps in a fourth-grade inclusion math class. The findings of the study included improved student learning. Ok & Bryant (2016)

explored the effects of an iPad-based intervention for elementary special education students to practice multiplication facts. The findings were that students improved use of the doubling strategy and automatically retrieved facts after the intervention. The value of using the iPad for math intervention was confirmed by the findings in other research (Bryant et al., 2015; Ok & Bryant, 2016).

Swicegood (2015) maintained that several schools have embarked on an initiative of giving students access to a hand-held device or a computer. The assumption is that technology integration improves student learning. In his study, Swicegood (2015) explored the effects of the iPad-use in a second-grade math class. The investigation on how iPad-use influenced teacher attitudes on using iPads, the pedagogical purposes of iPads, implementation issues, and student performance in mathematics using apps. The results were that many students generally reported enjoying using iPads in mathematics learning but others preferred the traditional methods of paper and pencil. Teachers believed that iPads were a motivating factor that increased student engagement and enabled for differentiation. Student performance was also higher when students were using apps but there was no evidence that apps influenced the higher quiz scores. IPad-use was also in two modes including focused and free choice. The implication of the study was that there is need for teacher support on integrating iPads in pedagogy. Support for teachers may enable teachers to create learning environments, as such suggested by UDL, to meet students' learning needs.

Weisel (2017) stated that early elementary mathematics forms the foundation of higher mathematics thinking and that the quality of instruction in mathematics has been a

longstanding concern. Weisel (2017) corroborated with Byno (2014) and Swicegood (2015) on the assertion that use of digital technologies increase student engagement. Weisel (2017) maintained teachers agree that technology integration provide opportunities for student collaboration. Maich, Hall, van Rhijin, and Henning (2017) examined iPad-users' attitudes and practices in elementary school classrooms. The researchers used student observations and student questionnaires to collect data. Data analysis yielded five themes including positive attitude towards iPads, enjoyable iPad-use, and preferred applications.

IPad Use in Middle School

Several studies investigated teacher perspectives on iPad-use in middle school settings (Smith & Santori, 2015; Ditzler et al., 2016). The perspectives vary from use of iPads being useful to being a distraction (Ditzler et al., 2016; Kirschner & van Merrienboer, 2013; Smith & Santori, 2015). Some of the distractions noted by iPad users included listening to music and texting (Ditzler et al., 2016; Kirschner & Van Merrienboer, 2013). There are mixed feelings among iPad users about whether iPad-use is beneficial in pedagogy. In the Ditzler et al. (2016) study half of the middle school participants either disliked or had mixed feelings about use of iPads. However, some studies noted several benefits of using iPads in middle school settings. Smith and Santori (2015) identified several themes including differentiation, learner autonomy, flexibility in teaching, collaboration, interaction, and engagement based on their study of iPad-use in middle school settings.

In other studies, results indicated that teachers' perspectives were that iPads were engaging and encouraged student creativity while at the same time some teachers had technical difficulties with iPad-use (Ditzler et al., 2016; Donehower, & Stone, 2014). O'Malley et al. (2014) studied the effects of iPads on the ability of students to complete academic tasks and the benefits and difficulties of iPad-use in a classroom with students with Autism. The findings included both an increase and a decrease in math skill development. The outcome also included student completion of tasks with less teacher prompting and noncompliant behaviors. These findings suggested that iPads are effective instructional tools that can improve student learning and independence (O'Malley et al., 2014). Bottge et al. (2015) examined the impact of instruction based on iPad math app use in middle school. The findings were that videos for anchored instruction improved student math scores compared to traditional methods of learning.

Byno (2014) carried out a qualitative study to investigate educators' experiences with implementing iPad technology into middle school pedagogy. The findings included student motivation, more collaboration among teachers, student engagement, and teacher enthusiasm for teaching. Byno's (2014) findings on student engagement support the Bottge et al. (2015) study-findings that students were engaged while using iPads for learning.

Ditzler et al. (2016) concur with Wishard's (2015) assertion that the new digital technologies are an inevitable part of the 21st century education landscape. Technology integration in the classroom is rapidly implemented. Ditzler et al. (2016) gathered data on middle school teachers' perceptions of using iPads. Emerging themes from interviews

included favorite apps, iPad as a distraction, iPad as a responsibility, like and dislike of iPads, and iPads as a pedagogical tool. Several challenges were described as students getting distracted by other features on the iPad, and learning to use the device. The implications included the need educator professional development on iPad-use and implementation.

IPad Use in High School

Special education students are increasingly being mainstreamed even in high school classrooms. Legislation requires that special education students receive instruction in mainstream settings where they can have equal learning opportunities as their counterparts (Powell, 2014). The Common Core State Standards require all teachers to make the curriculum accessible to inclusion students with learning disabilities. However, teacher perspectives are that there is minimal preparation during college training for such working environments (Vitelli, 2015). Vitelli (2015) argued that students' low academic achievement can be attributed to the inadequate teacher preparation.

Watt et al. (2016) noted that in mathematics, general education students outperformed special education students. In eighth grade, the achievement gap in scaled scores between special education students and their counterparts was 46 points while in twelfth grade there was a 40-point difference (Watt et al., 2016). The wide math achievement gaps warrant research on effective practices in math classes aligned to the math standards (Watt et al., 2016) to support students in math learning. Many educators are excited about using iPads in the classroom (Maich & Hall, 2016; Mango, 2015) and technology integration in mathematics has received widespread endorsement (Ok &

Bryant, 2016). Technology integration is recommended for effective math instruction (Ok & Bryant, 2016). However, few studies address iPad users' experiences in higher mathematics classes (Wishard, 2015).

Since research-based evidence of using iPads in the classroom is just emerging, teachers may have challenges in effective implementation (Maich & Hall, 2016). Grant et al. (2015) investigated use of iPads in elementary and high school classrooms to gain insight on how the devices were used in the classrooms. Studies showed that there are several potential uses of iPads in the classroom including engaging learners, connectivity, collaboration, authentic learning (Grant et al., 2015). The iPad has game-based apps with multi-sensory content facilities and reinforces student learning (Perry & Steck, 2015). Perry and Steck (2015) explored use of iPads as an instruction tool on engagement, self-efficacy, and on to improving performance in geometry standards. Availability of apps promotes reasoning about geometry concepts, and collaboration (Perry & Steck, 2015).

Summary and Conclusions

Since technology is an essential part of the 21st century pedagogical landscape, positive social change can occur when iPad-use for math inclusion students with learning disabilities is effectively implemented. Evidence from research on use of iPads in math classroom is surfacing (Maich & Hall, 2016) but limited for higher grade levels (Wishard, 2015; Zhang et al., 2015). On the other hand, the new rigorous math standards and the technology standards push for integration of technology in instruction resulting in teachers challenges on how to implement both standards. In addition, the increased number of special education inclusion students with math learning disabilities pose

another challenge to teachers who lack the skills of making the curriculum accessible to all students. Even though several emerging research investigates iPad-use in the education landscape including the experiences of iPad-use in elementary school and with children on the Autism spectrum, the gap in literature is in the investigation of iPad-use in higher math inclusion classes. The major themes emerging in the literature review include student engagement, authentic learning, improved student learning, increased student performance, and technical difficulties with using iPads. This study provides insights on the using iPad in math inclusion classes to guide decision making for future implementation in higher math classes. Chapter 3 is a description of how the study was carried out in eighth grade math inclusion classrooms.

Chapter 3: Research Method

In this qualitative single case study, I explored the experiences of teachers and special education students using iPads in eighth grade math inclusion classes that use the Common Core state standards. Even though special education students have been using computers for years, academic achievement for special education students continues to raise concerns among educators (Satsangi et al., 2018). In this study, I investigated the experiences of eight-grade inclusion teachers and special education students using iPads in the Common Core math curriculum, and described the experiences of eighth-grade inclusion teachers and special education students using iPads in the rigorous math curriculum. There is abundant literature on the incorporation of technology in classroom curricula but limited studies on the impact of iPads on inclusion special education students (Bottge et al., 2015) and on the experiences of iPad users in the rigorous math curriculum.

In Chapter 2, I reviewed studies that highlighted the benefits of iPads for instruction and learning in content areas including mathematics. The review of literature revealed that teachers struggle with effective choice of apps relevant for Common Core math standards and also revealed that teachers struggle with the integration of technology (Ryan & Bagley, 2015). The literature review also revealed that general education students surpass inclusion students in academic achievement in content areas including math.

The first section in Chapter 3 is a description and justification of the design of the study. The two research questions are stated and the technology integration concept is

described. The qualitative research tradition is described. In the next section, I define and explain my role as the observer and interviewer and explore researcher biases and ethical issues. In the methodology section, I identify the participants and describe and justify the sampling method used. The next section addresses the instruments for data collection including audiotapes and observation sheets. Finally, I describe the process of collecting and analyzing data and discuss issues of trustworthiness. The last section summarizes Chapter 3 and provides an introduction to Chapter 4.

Research Design and Rationale

I conducted a qualitative single case study of a school with two eighth-grade inclusion math classes. The research questions supported a qualitative single case study that was designed to investigate the experiences of eighth-grade math inclusion Common Core teachers and special education students using iPad apps. The experiences and perceptions of iPad users for Common Core math standards are central to an understanding of how integration of technologies such as iPads in math influences learning and instruction in math inclusion classes. This design was ideal for a study of a case within a contemporary context (see Yin, 2009). The contemporary case was a school with inclusion eighth-grade Common Core classes with special education students using apps for a math curriculum. A single case study approach allowed me to investigate in detail and collect data using various methods for triangulation, including individual interviews, direct lesson observations, samples of student work, and teacher lesson plans.

This study was designed to describe the experiences of iPad users such as inclusion teachers and students with MLD in their naturalistic setting. A single case study

allowed for an extensive collection of data, triangulation, and a deeper analysis of the data, and it was less time consuming (Miles, Huberman, & Saldana, 2014). The single case study was a middle school with two eighth-grade classrooms in which iPads were used for math instruction and learning. A single case study is ideal when seeking to investigate the experiences of participants because it allows for an illustration of a case that has a unique interest in a concept (Yin, 2009) such as technology integration in the form of iPads.

The research questions below were designed based the theoretical and conceptual framework (see Janesick, 2016) and the gap in knowledge:

1. What are the experiences of eighth-grade math inclusion teachers with using iPad in inclusion Common Core classes?
2. What are the experiences of eighth-grade students with math learning disabilities using iPads in inclusion Common Core classes?

Smith, Flower, and Larkin (2009) defined theory in qualitative research as a lens to view the participants' experiences. The experiential learning theory and the integration of technology conceptual framework, as described in the UDL and the TPACK model (Koehler et al., 2014), guided and justified the research approach. The Common Core math standards and the technology standards advocate for the use of technology in the classroom. The conceptual and theoretical framework helped in identifying the meaning of the experiences of using iPads in inclusion Common Core classes.

Role of the Researcher

In this study, I observed lessons, interviewed teachers and students, and collected artifacts. I collected all data, transcribed the interviews, coded and categorized interview responses, identified emerging themes, analyzed contents of documents, and interpreted the findings. Miles et al. (2014) pointed out that researchers have personal perspectives that can influence a study.

Possible biases in this study were considered. I have eight years of experience in inclusion math classes, and I am also an advocate of technology integration and assistive technology. I have perceptions about technology integration and math learning. I taught students with learning disabilities for 13 years and used technologies such as iPads for 2 years for math interventions using an online study island program.

Interviews of both teachers and students were carried out and recorded on audiotapes. As an interviewer, I conducted teacher and student interviews at locations comfortable for the interviewees. The goal of using qualitative interviews was to understand the iPad users' experiences in their naturalistic setting (see Patton, 2015). Researcher biases were managed by conducting research in a school other than my school of employment.

Rapport was established with the interviewees to make them comfortable with me and to convey to them that their knowledge, experiences, perceptions, and attitudes are important (see Patton, 2015; Smith et al., 2009). At the same time, maintaining empathetic neutrality was necessary (see Patton, 2015). This meant respecting interviewees' feelings, experiences, attitudes, and perceptions about iPad use. As a

special education teacher, I minimized my bias regarding students with learning disabilities by staying rational and independent (see Patton, 2015).

I combined the informal conversational interview with the interview guide. The interview guide allowed me to explore predetermined topics and issues (Patton, 2015). The benefit of using an interview guide was that it increased the comprehensiveness of the data and allowed me to build conversations within the predetermined topics. The predetermined topics included use of iPads, benefits, challenges, and experiences. Combining informal conversation with the interview guide provided flexibility in probing and exploring certain subjects in greater depth (see Patton, 2015). The conversational interview allowed me to ask questions that arose from the immediate context (Patton, 2015), and I was able to use this process when asking follow-up questions. The advantage of using the conversational interview was that there was increased relevance of questions because they were asked in context and in the natural course of things (see Patton, 2015). Another advantage of conversational interviews was that I asked questions arising from the interview responses to seek clarification of the participants' responses. The downside of using conversational interviews is that different information can be collected from different people (Patton, 2015).

For the interviews, I used standardized open-ended questions from the interview guide to minimize variations in the questions posed to the interviewees (see Patton, 2015) and to efficiently use interviewees' time. Another advantage of using standardized open-ended questions was that when data were analyzed, responses were easy to find to make comparisons (see Patton, 2015). One disadvantage of using standardized open-ended

questions was that I could not ask questions on topics or issues that were not included in the protocol.

Ethical issues related to my role as the researcher included collecting data in my district of employment. To address this, I collected data at a school site that was not my workplace. As a special education teacher, I may have encountered power differential issues with special education students who participated in the study. This was addressed by using students from a school that I was not working in.

Methodology

This section offers a discussion of the rationale for participation selection, recruitment, trustworthiness issues, instrumentation, and data analysis. The purpose of the study was to explore the experiences of eighth-grade teachers and special education students using iPads in inclusion math settings to inform other educators regarding iPad integration in their inclusion math curriculum.

Participant Selection Logic

Sampling in qualitative research is theory driven (Miles et al., 2014). The TPACK framework and technology integration guided this study. I interviewed participants who met the iPad-use criteria. I chose one significant case, a middle school with inclusion classes that included iPads. This allowed me to select participating teachers and students who met the participation criteria. One case provided a deeper insight on the use of iPads.

The participants were two eighth-grade math inclusion classes. Participants from the classes were two co-teachers and eight student participants (four girls and four boys). Using the same teacher participants for two different classes allowed for the control of

variations in teacher qualifications and different teaching strategies by different teachers that may have influenced the results of the study. Because many middle school students with special needs are below the age of 18, I purposefully selected their parents who had parental rights to give consent for their children as long as the students assented to participating in the study (Appendix G). I chose student participants by sending invitation letters to eight invitees at a time, four from each class. When one of the invitees declined to participate, I sent the invitation letter to the next potential participant who met the criteria until a total of eight students assented to participate.

Teacher participants met the following criteria: (a) eighth-grade math-inclusion special education and regular education teachers within the proposed research site, (b) special education teacher held a clear mild or moderate teaching credential required by the California Commission for Teaching Credentials, (c) regular education teacher held a single subject math credential required by the California Commission for Teaching Credentials.

Student participants met the following criteria (a) identified as inclusion students (b) did not have Intellectual Disability (c) were in an inclusion math class having iPads for the Common Core math curriculum, and (d) students had a math IEP goal. From each participating class, two students were female and the other two were male. I used the special education inclusion teacher with access to student IEPs to obtain contact information to send consent letters to parents.

The availability of participants and time factor influenced the sample size. The small sample size ensured an in-depth collection and analysis of data. The sample size

determined the quality of data collected rather than quantity. A sample size of 8 students whose demographics were representative of all inclusion students with MLD was adequate to provide in-depth collection of data (Maxwell, 2013). An in-depth collection of data provided a deeper understanding of the experiences of iPad-app users. Exploring the stories of other iPad users, such as those in inclusion math settings, may inform other educators willing to integrate iPads into their inclusion math curriculum. The voices of the participants were crucial and prioritized in exploring use of iPads in eighth-grade math inclusion classes.

To invite participants, I emailed an invitation letter to inclusion eighth-grade math teachers in the first potential school site (Appendix A). Two inclusion teachers agreed to participate by signing the consent form (Appendix F). Students who met the participation criteria were invited from the responding teachers' classes. I sent an invitation (Appendix G) and consent letter to parents or guardians of the first four potential students randomly chosen in each of the participating classrooms (Appendix B). Students that gave assent to participating in the study also signed the minor assent form (Appendix H) as an indication of reading and understanding the invitation letter (Appendix J). The teachers were representative of eighth- grade inclusion teachers in one middle school. Student sample size was adequate to be representative of mainstreamed students in math classrooms.

Instrumentation

Data collection tools must align with study design and the research questions (Yin, 2009). Interviews, direct lesson observations using an observation protocol

(Appendix C), samples of student work, and teacher lesson plans were the primary sources of data collection and allowed for the collection of data that answered the research questions. I interviewed teachers and students on their experiences using iPads in Common Core math classes. I conducted direct observations to gather data on observed experiences. During observations, student activities and teacher activities were recorded on the observation instrument (Appendix C). Using different methods to collect data (observations, interviews recorded on audiotapes, and samples of student work, and lesson plans) was a way of dealing with validity threats. Several methods of collecting data reduced the risk of conclusions biased to a specific data collection method.

Classroom Observations

I created an observation instrument (Appendix C) to record the observations. I conducted three classroom observations in each of the two participating classes over a period of one week. Observing participants using the iPad allowed me to describe settings, events and behaviors (Maxwell, 2013; Yin, 2009) of iPad users. Classroom observations enabled me to see first-hand (Patton, 2015) how teachers and students used iPad in an inclusion math class hence helping to collect data for both research questions. During observations, I used the classroom observation instrument to record student and teacher behaviors, iPad activities, and interactions between teachers, students, and between teachers and students. Another value of using field observations is that as an observer I observed iPad-user experiences that participants were unwilling to talk about in an interview (Patton, 2015; Yin, 2014). I also used the instrument to indicate the class observed, length of activity, descriptive notes, and reflective notes (Yin, 2009).

Interviews

Interviews were an important instrument to collect data with the goal of answering research questions on the experiences of iPad users because how participants feel, think, and what their intensions were, could not be observed. The purpose of interviews was to allow me to capture the iPad users' perspectives and experiences about use of iPads in an inclusion class. Asking clear and understandable probing questions allowed for greater depth and detail of personal stories of the participants (Patton, 2015). Interviews also enabled the capturing of behaviors that took place before the study and capturing meanings that iPad users attach to what goes on with their experiences with the iPads in math instruction and learning.

A combination of the interview approaches allowed for flexibility in asking probing questions and making decisions on when to explore certain topics at depth (Patton, 2015). Interviews supported direct observation in the field and they allowed for comparisons between responses and categorizing responses into common themes (see Patton, 2015). Interview guides with relevant and meaningful questions helped in the collection of thoughtful and in-depth responses that captured what was important to the interviewee. The interview questions were open-ended.

Teacher interviews. I created a teacher interview guide (Appendix D) that I used to conduct interviews for each of the participating teachers. Two interviews for each teacher were conducted. The follow-up interview questions arose from the responses in the preliminary interview (Appendix D). The follow-up interview had questions that sought clarification on responses given in the primary interview. Appointments with

teachers for the follow-up interviews were set after the preliminary interviews. Interviews were held before and after school hours and at each teacher and student preferred location and time. The preliminary teacher interview (Appendix D) addressed the following topics using the questions on the interview guide (a) inclusion teachers' experiences and opinions in using iPads for eighth-grade Common Core curriculum, (b) challenges inclusion teachers believe students with math learning disabilities face when using iPads to learn the eighth-grade Common Core Standards on expressions and equations, and (d) recommendations on improving use of iPads for the Common Core math curriculum.

Individual student interviews. To conducted individual student interviews, I gave clear explanations for the purpose of the interview. I offered an introduction of my role in the school community as a teacher in a local school in order to gain trust of student participants. I also gave the ground rules for participation in the individual interview. Students were informed that they were free to ask for a break at any point during the interview. Students were also informed that the individual interviews were audio-recorded.

The student interview guide that I created had eight questions as shown on Appendix E. The following topics were addressed (a) the students' experiences and perceptions of using iPads for eighth-grade Common Core curriculum addressing expression and equations standards, (b) the benefits students believed they receive when using iPads to learn the Common Core Standards on expressions and equations, (c) the challenges students believed they faced when using iPads for Common Core math curriculum.

I used an iPhone to record teacher and student interviews. The benefit of recording is that audio captured every word the interviewees said in order to precisely transcribe the interview (Yin, 2009). Audio recording enabled me to focus my attention on the interviewee and to capture every detail of the interviewee responses.

Artifacts: Teacher Lesson Plans and Student Work Samples

Artifacts in the form of written documents (samples of student work and teacher lesson plans) were used to gather data. An analysis of the contents of the lesson plans helped to understand how inclusion teachers integrated iPads in the Common Core math curriculum. Teacher lesson plans gave valuable insight on the experiences of both teachers and students using iPad for math in the Common Core curriculum. Lesson plans as a data collection instrument complimented interviews and observations. Analyzing student work samples also gave an insight on the experiences of students with using iPads for math.

Procedures for Recruitment, Participation, and Data Collection

The selection of a school site that has a data rich environment was crucial. The research site had eighth grade inclusion classes that used iPads for the Common Core curriculum. Factors considered were accessibility, the availability of math inclusion classes, and the ability of remaining unobtrusive. I purposefully selected the case study of a school in the district that I worked in for accessibility but a different school from my teaching assignment for me to remain unobtrusive. First, I obtained IRB approval (Appendix K), then cooperation by the school district to collect data (Appendix J). Next,

I emailed the school principal of one of the potential school sites and obtained a confirmation to use the school for the purpose of recruiting teachers and students.

I contacted the parents of potential student participants through a mailed package containing a parent invitation letter, parent consent form, and student assent form. Most students needed parental consent to participate because they were special educations students and under age. After obtaining teachers and students agreement to participate, and parent consent, I discussed the scope of the study, the ability of participants to exit the study without fear of any penalty.

I identified a school with eighth-grade inclusion classes that used iPads for the Common Core math classes. I used convenience sampling to choose a school that was easily accessible. The purposefully selected school provided rich and deep understanding and breakthrough insights (Patton, 2015) in iPad-use in inclusion math classes. Participants exited the study after member checking in which participants checked the descriptions of the interviews for credibility purposes. I invited participants to a debriefing meeting on the results of the study and sent an e-mail to thank them for being part of the study.

Data Collection

From the participating classrooms, I collected data through direct observations, teacher and student individual interviews using audio recordings, and artifacts in the form of lesson plans and student work samples. I used the interview guides with questions created to suit the teacher interviewees (Appendix, D) and to suit the student individual interview (Appendix, E) to gather data on the stories of participants regarding their

experiences with iPads. Three observations of the participating classes during a Common Core unit of study with word problems were carried out in the three weeks of the study. One observation a week in the participating class was conducted during the three-week study for an entire class period. During the observations, I used the observation instrument (Appendix C) to record teacher and student interaction with the iPad for learning purposes. I also recorded my reflection notes on the observation instrument.

For the individual interviews, I used the interview guides (Appendix D and Appendix E) for teachers and students respectively. Student individual interviews were conducted at the school and at a location away from other non-participating students and away from their teachers where students felt safe to share their experiences. Audio recording the interviews using an iPhone enabled the capturing of every word that the interviewees said. The advantage of this was that the audio provided an opportunity to capture details of the experiences of the interviewees.

Artifacts (samples of student work, and teacher lesson plans) were used to gather data on iPad-use. From the lesson plans, I looked for where in the lesson iPads were used by the teachers and by the students, what the iPads were used for, and how they were used. I also looked for specific apps used and what they were used for. In the student work samples, I looked for information on how students used iPads for learning. The data collected might give more insight on using math iPad apps at middle school level. Using multiple sources of data collection (interviews, direct observations, samples of student work, and lesson plans) corroborated stories on experiences of iPad-users.

Data Analysis Plan

The data sources I used included (a) direct lesson observations, (b) interview audio recordings, (c) lesson plans, and (d) student work samples. Observations helped me get first-hand information that answered the question on the experiences of using iPads in a math classroom with a Common Core curriculum. I used the observation field notes to write a formal description of how iPads were used in inclusion math classes to influence teachers' and students' experiences with the technology. Interview audio recording captured what inclusion teachers and students said about their experiences with using iPads.

Student individual interviews were carried out after school or before school at the school site. This allowed me not to interfere with instruction time. Teacher interviews were carried out after school or before school and at locations convenient to the teachers using the teacher interview questions (Appendix D). I listened to the interviews on audio-tapes and transcribed them verbatim to capture details of what the interviewee shared so as to be able to make an interpretation outside the context of the interview (Smith et al., 2009). A verbatim transcription enabled me to identify in vivo codes, cluster codes into categories, and identify emerging themes. On the transcriptions, I highlighted repetitive words to look for codes and discrepant data.

To manage and code participant responses, I used two levels of coding, the first cycle and the second cycle recommended for beginning researchers (Miles et al., 2014). Coding the data helped me answer the research question on the experiences of inclusion teachers and students using iPads in an eighth-grade. In the first cycle of coding I

highlighted repetitive words as emerging themes. Using the emerging themes, I categorized data from each interview transcript and observation data instrument. First cycle coding allowed for the narrowing of collected data into a convenient size. From the codes, I created data categories.

At the second cycle of coding, I used all the data sources (interviews, student work samples, lesson plans, and observations) to review the data a second time by highlighting words that appeared common among the sources (repetitive words) and the different words that carried the same meaning. Repetitive coding enabled me to derive themes that emerged from clustering codes. I analyzed the emerging themes as findings and using the two research questions. After coding, I shared the data with the participants to allow for credibility. I identified discrepant data and discussed with the relevant participant. Discrepant data were used to broaden discussions about experiences with iPad-use by inclusion math students with learning disabilities. Table 1 shows the research questions, data collection sources, data collection instruments, time frames, and methods of data analysis.

Table 1

Summary of Data Collection Tools

Research question	Source	Timeframe	Instruments	Analysis
What are the experiences of inclusion teachers using iPads in eighth-grade Common core math classes?	-Classroom observations -Teacher lesson plans -Teacher interviews	-Weeks 1, 2, 3 -Weeks 1, 2, 3 -Week 1,3	Observation instrument Teacher interview protocol Audio-Tape	Thematic hand coding, categorizing, and content analysis
What are the experiences of inclusion students using iPads in eighth-grade Common core math classes?	-Classroom observation -Student work-samples -Student individual interview	-Weeks 1, 2, 3 -Weeks 1,2, 3 -Week 1	Observation instrument Student interview protocol Audio Tape	Thematic hand coding, categorizing, and content analysis

Issues of Trustworthiness

Credibility

Factors influencing the credibility include in-depth fieldwork that produces high quality data, organized and diligent analysis of data, and credibility of the research depending on how the researcher presents himself or herself (Patton, 2015). Credibility is also referred to as validity (Yin, 2014). Triangulation helped me to evaluate strengths and

limitations of various methods collecting data to support the conclusions to be made (Maxwell, 2013). Triangulation is a way of dealing with validity of threats in that it reduces the risks of basing research conclusions on one specific method (Maxwell, 2013). Yin (2014) described triangulation as using various theories, sources, and methods to corroborate evidence in a study. An in-depth field work using triangulation including collecting data through observations and field notes, audiotaping, and interviews will give conclusions more credibility and provide corroborating evidence (Yin, 2014). To organize and diligently analyze data and to provide validity to findings, I used different sources of data to find a common theme or code (Yin, 2009).

To ensure credibility, each participant's data was explored and a description of their lived experiences was made. Member checking is a strategy of establishing credibility. The participants were able to check the findings for validity and clarity. Participants also reviewed the results and conclusions of the study for credibility (Yin, 2009).

Transferability

Transferability refers to external validity. Research results have external validity if they can be relevant in other settings. For transferability, I ensured variation in participant selection. Because of the variation in participant selection, any discrepant cases arising were explored and described to deepen the understanding of the phenomenon. Transferability can be influenced by how observations are done. Observations can be done overtly or covertly (Patton, 2015). Even though covert observations are more likely to capture a lot of what happens during iPad-use without the

observed being influenced by the presence of the observer, I observed overtly. This is ethical and moral in that I first informed the participants that they were being observed and provided them with a full disclosure of the purpose of carrying out the observation and how the results of the study were going to be used (Patton, 2015).

Dependability

Dependability refers to reliability. To establish dependability, I used the observation instrument to record observations. For interviews, I established dependability by using my iPhone video recording to produce good recording and to capture everything in the interviewee stories about their experiences with using iPads. After the interviews, I transcribed the tape. Using codes and categorizing information from different transcripts into codes I collapsed the codes into major themes.

Confirmability

For objectivity, I did not carry out the research on my school campus to avoid vested interest in the research. The outcome of the research was not influenced by my biases as the researcher but informed by data analysis. I kept a research journal to make notes on my feelings during each observation (Appendix C).

Ethical Procedures

Since the study involved students with learning disabilities, one of the ethical issues I considered in planning for my research was accessing legal documents of special education students. To overcome this challenge ethically, I included students who already had IEPs that indicated that they had math calculation challenges. I was able to do that by doing criterion sampling and convenience sampling. To select students for participation,

convenience sampling was done in the classes of teachers that had already consented to be part of the study. For convenience sampling, an invitation was sent to inclusion special education teachers with a caseload that had students with math calculation skills as one of the challenges recorded in their IEPs. That way I did not have to ask to look into the legal documents such as IEPs. Also, since participating students were minors, I obtained IRB approval (Appendix K; approval # 08-22-18-0228204) to observe them and interview them. The convenience sampling method was also criterion-based. Participating students had a math learning disability. Participants provided consent (Appendix B and Appendix G). Random sampling was used to avoid selecting sites that with interests in the study and results. I sent invitations to one school at a time until one school principal provided consent for me to access the school for the purposes of recruiting participants and collecting data. Next, I sent emails to one set of inclusion teachers at a time until I obtained teacher signed consent forms.

I revealed the purpose of the study on the informed consent form that was reviewed by the IRB. I informed participants that they were participating voluntarily and that withdrawing from participation could be at done any time without penalty. In addition, I informed the participants that any information given was confidential in that audio-tapes were going to be kept safe under lock for five years according to the institutional recommendation. It was also ethical for me to discuss alternative views obtained from data collection.

Summary

The purpose of this single case study was to describe the experiences of eighth grade inclusion teachers and special education students with the use of iPads in an inclusion class with a Common Core standards-based math curriculum. In Chapter 3, procedures for the study are described. Observations, interviews recorded on audio using an iPhone, samples of student work, and lesson plans were used to obtain information on use of iPads in a Common Core math class and the subsequent experiences of the users. Open-ended interviews were used to get information on the experiences of both inclusion math teachers and special education students. Data analysis strategies were described to include transcription, hand coding, creating themes, and categorizing data. I discussed ethical issues and included observing confidentiality of personal information about the participants. I obtained IRB approval to carry out the research with participants described. Chapter 4 is a discussion of the results of the study.

Chapter 4: Results

The purpose of this qualitative single case study was to investigate the experiences of inclusion teachers using iPads for the common core eighth-grade math curriculum, and investigate the experiences of students with math learning disabilities using iPad apps for the Common Core eighth-grade math curriculum. Dewey's (1938) theory of experiential learning and the technology integration conceptual framework in conjunction with the TPACK model were the lenses I used to analyze data gathered through teacher interviews, student interviews, lesson observations, samples of student work, and lesson plans to understand teacher and student experiences with using iPad apps in inclusion math classes. Two research questions guided the study:

Research Question 1: What are eighth-grade math inclusion teachers' experiences with using iPads in inclusion eighth-grade Common Core math classes?

Research Question 2: What are the experiences of eighth-grade students with math learning disabilities using iPads in inclusion eighth-grade Common Core math classes?

In this chapter, I describe the setting and data collection processes. I also describe data analysis procedures and evidence of trustworthiness. Next, I describe the results and summarize the chapter.

Setting

With the approval letter to collect data in the school district (Appendix J) and IRB approval (Appendix K), I e-mailed the school site principal seeking access to the school for the purpose of recruiting participants. I received agreement confirmation through a

text message from the school site principal confirming cooperation for data collection. Sundance Middle School (pseudonym) in California had a total of four eighth-grade inclusion math classes with a pair of inclusion teachers co-teaching two eighth-grade math classes. Each pair of inclusion teachers included a regular education teacher and an education specialist. Only one of the two pairs, Mr. Peters and Mr. Williams (pseudonyms), signed the teacher consent forms (Appendix F). Mr. Peters was the regular education teacher, and Mr. Williams was the education specialist with a special education teaching credential. The two inclusion teachers co-taught two eighth-grade math inclusion classes that participated in the study. Mr. Peters and Mr. Williams used the same classroom at different time periods for the two inclusion classes that participated in the study. In the math inclusion classroom in which data were collected, there was an interactive whiteboard and an iPad cart.

Having the same teachers in the same classroom for two classes could have influenced the outcome of the study because teachers could use the same resources found in the classroom and the same lesson plans to teach two different eighth-grade classes. Mr. Williams, the special education inclusion teacher, wrote all the IEPs for all eighth-grade inclusion students. He was the case manager for eighth-grade inclusion students. Convenience sampling of an inclusion teacher who was the case manager of special education students enabled access to parent contact information and student IEP goals and accommodations.

Demographics

Teachers' Demographics

Out of four inclusion eighth-grade math teachers at Sundance Middle School, two co-teachers gave consent to be part of the study. Mr. Peters and Mr. Williams met the criteria that (a) they were eighth-grade math inclusion co-teachers, (b) they were a regular education teacher and an education specialist who co-taught the class, and (c) they used iPads for the common core eighth-grade math class. Both teacher participants were male. I assigned pseudonyms to teacher participants for confidentiality. Table 2 summarizes the demographics of teacher participants.

Table 2

Demographics of Teacher Participants

Teacher participants	Gender	Highest level of education	Credential	Years of experience with iPad-apps
Mr. Peters	Male	B.A Mathematics	Single Subject-Mathematics	8
Mr. Williams	Male	M.A Special Education	Education Specialist	4

Mr. Peters. Mr. Peters was the general education inclusion teacher participant. His education level included a bachelor's degree in mathematics and a single subject mathematics credential. Mr. Peters had 16 years of experience teaching math at the middle school level. Of the 16 years of teaching, 8 years were in teaching eighth-grade math inclusion classes using iPads. At Sundance Middle School, Mr. Peters was one of the leaders in using technology. On the day of the first lesson observations in Class 1, the

school principal came into the classroom before the lesson started and asked Mr. Peters to allow a professional development guest to observe his lesson with a focus on technology integration.

Mr. Williams. Mr. Williams was the special education inclusion teacher participant with 28 years of experience. His qualifications included a master's degree and a California Education Specialist credential authorizing him to work with special education students. Mr. Williams had been an eighth-grade math inclusion teacher for 4 years and had 4 years of experience using iPads in a math class. He was also the special education case manager for potential student participants. As a case manager, he wrote students' IEPs that included math goals for students with math skills deficits, and he had access to parent contact information.

Students' Demographics

Of the 18 potential special education inclusion student participants, I sent invitations to eight students at a time. I recruited a total of eight student participants from two inclusion classes taught by the same inclusion teachers, Mr. Peters and Mr. Williams. Of the eight students, four were chosen from each participating class. I gave pseudonyms to student participants for confidentiality. Participating students were Ariana, Bianca, Cathy, Daneshia, Enrique, Francisco, German, and Harry. From Class 1, students who participated were Bianca, Daneshia, Francisco, and Harry. Class 2 participating students were Ariana, Cathy, Enrique, and German. From each class, there were two female and two male students. Of the four total participating female students, two were African

American, one was White, and one was Hispanic. Participating male students included three Hispanic students and one White student.

All eight special education student participants had a math goal in their IEP, which indicated that math was one of their areas of deficit in learning. Mr. Williams identified potential student participants because he had access to their IEPs. The student participation criteria included (a) must be in an eighth-grade inclusion class, (b) must have an IEP with a math learning goal, and (c) must have a mild to moderate learning disability. All participating students' math goals were solving word problems with at least 80% to 85% accuracy. Table 3 summarizes the student demographics.

Table 3

Demographics of Student Participants

Student participants	Gender	Race	Age	Years using iPad apps	Disability	Accommodations
Ariana	Female	Hispanic	12	2	Specific Learning Disability (SLD)	Use of calculator Text-to-speech Extra time to complete assignments Use of highlighters Directions explained and simplified
Bianca	Female	White	12	3	SLD	Use of calculator Text-to-speech Extra time to complete assignments Color overlays Use of earphones One to two step Directions
Cathy	Female	African American	13	4	Autism SLD	Use of calculator Text-to-speech Extra time to complete assignments Written and verbal one to two step directions
Daneshia	Female	African American	14	4	SLD Speech	Use of calculator Text-to-speech Extra time to complete assignments Written and verbal one Directions
Enrique	Male	Hispanic	15	5	SLD Speech	Use of a calculator Text-to-speech Extra time to complete assignments 5-minutes one-on-one time with teacher for individual assistance Shortened assignments

(*Table continues*)

Student participants	Gender	Race	Age		Disability	Accommodations
Francisco	Male	Hispanic	15	1	SLD-Auditory Processing Attention Deficit Hyperactivity Disorder(ADHD)	Use of calculator Text-to-speech Extra time to complete Assignments Use of highlighters
German	Male	Hispanic	14	1	SLD	Text-to-speech Speech-to-text, Extended time to complete assignments, Shortened assignment
Harry	Male	White	13	4	SLD	Use of a calculator Text-to-speech Simplified directions Extra time to complete assignments

Ariana. Ariana was a 12-year-old female student of Hispanic origin. She had used iPad apps in a seventh-grade math class at junior high school. Ariana was in her second year of using iPad apps for math learning. Mr. Williams shared that Ariana's primary disability, as stated in her IEP, was specific learning disability (SLD). According to the special education teacher, SLD was not further explained in Ariana's psychological report

Bianca. Bianca was a 12-year-old White female student with a primary disability identified her IEP as SLD. Mr. Williams shared that the SLD was explained in Bianca's psychological report as auditory processing. Despite exhibiting hearing acuity that is close to normal, students with auditory processing disorders have listening difficulties (De Wit et al., 2016). Bianca had prior experience with using iPad apps for math learning in Grades 6 and 7. Bianca had 3 years of experience with iPad use in a math class.

Cathy. Cathy was a 13-year old African American girl whose primary disability was stated in her IEP as autism; an SLD explained as auditory processing was stated as a secondary disability. Cathy used iPad apps for math learning in Grades 5, 6, and 7. Cathy had 4 years of experience with iPad app use in a math class.

Daneshia. Daneshia was an African American 14-year-old female student. She started using iPad apps for learning math in elementary school. Daneshia had four years of experience with using iPads. Daneshia's disability was (SLD) and Speech was a secondary disability. She had a word problem math learning goal similar to all participating students.

Enrique. Enrique was a 15 year-year-old male student of Hispanic origin. His primary disability was recorded as specific learning disability (SLD) and the secondary disability was recorded as Speech. According to Mr. Williams, SLD was not elaborated in the student's psychologist's report. However, it was noted that Enrique had math calculation skill deficits justifying the math goal in his IEP. Enrique had used iPad apps for math learning in grades four, five, and seven. Enrique was in his fifth year of using the iPad in math learning.

Francisco. Francisco was a 15-year old student of Hispanic origin. His primary disability was also recorded in his IEP as SLD and, according to Mr. Williams, explained as auditory processing in the Psychologist's report.

German. German was a 14-year-old male student of Hispanic origin. His primary disability was recorded as SLD with Attention Deficit Hyperactivity Disorder (ADHD) recorded as a secondary disability in his IEP. According to Wiersema and Godefroid

(2018), ADHD is a result of impaired self-regulation also referred to self-regulation deficit. Wiersema and Godefroid (2018) further explained ADHD as a neurodevelopmental disorder with symptoms including inattention, and hyperactivity and/or impulsivity. Math calculation was among skill deficits that justified the math goal set in German's IEP. German had one year of experience with using iPads in a math class.

Harry. Harry was a 14-year-old white male student. His primary disability was also stated in his IEP as specific learning disability (SLD). Harry had four years of experience with using iPad apps for math learning.

Data Collection

I collected data from two classes having iPads and taught by the same inclusion teachers. In total, I collected data from two co-teachers and eight students. Sundance Middle school had four 8th grade math inclusion teachers. Collecting data from two teacher participants enabled an in-depth exploration of the experiences of inclusion teachers with iPad-use in a Common Core math class. Purposively selecting a small sample of eight students ensured that the sample was rich in meeting constituencies, diversity, and characteristics it represented (Ritchie & Lewis, 2003). The selection process began immediately after obtaining the school district letter of cooperation, IRB approval, and school site principal agreement to access the school. I sent an email to the school site administrator seeking access to the school for data collection. I received the school site administrator's verbal and an SMS text message agreement to access the school for the purpose of recruiting teachers and students for participation in the study.

Data collection took place for three weeks beginning end of September to second week of October.

I sent invitation packages (invitation letters and consent forms) to the first set of co-teachers who taught an 8th grade math inclusion class. After the two teachers gave consent to participate in the study, I sent four packages containing parent invitation letters (Appendix G) and consent forms (Appendix B), and student invitation letters (Appendix I) and assent forms (Appendix H) to potential student participants in each of the two potential participating classes. The first response from the parents and students was a parent declining to give consent. The student returned the parent consent form with a note to decline but did not return the student package. I immediately sent another package to the next potential parent and student participant identified by the inclusion special education teacher as meeting the criteria. After getting a total of eight students assenting to participate and parents giving their consent, I began to collect data. Four of the students who agreed to participate were from class one and the other four were from class two.

First, I scheduled for lesson observations and teacher interviews. Each teacher provided his preferred interview date and place of interview. Next, I scheduled student interviews. Each student provided his/her preferred interview time and location. Multiple sources of data illustrated on table 4 provided triangulation. The following table summarizes the research questions, focus areas, and the data gathering instruments.

Table 4

Research Question by Number, Focus Area, and Data-Gathering Instrument

Research question	Focus area	Preliminary interview question	Follow-up interview question	Lesson plan and student work sample
1	Teacher experience with using iPad-apps for common core math	1,3, 4, 6, 7,8, 9, 10, 11, 12, 13, 14, 15, 16, and17	1, 2, 3, 4, and 5,	Common Core Standard Lesson objective Type of app used Teacher activities
2	Student experiences with using iPad-apps	1, 2, 3,4, 5, 6, 7,8, 9, 10, and11		Student activities Student work samples

Teacher Preliminary Interviews

I conducted teacher interviews during the first week of the study using the teacher interview guide (Appendix D). The general education teacher, Mr. Peters, chose to be interviewed during the first week of the study immediately after school hours in his room. The interview was carried out behind closed doors for 60 minutes long. The special education teacher, Mr. Williams, chose to be interviewed during his planning period in his room. The 50-minute long interview was carried out behind closed doors. I used the teacher interview guide (Appendix D) to collect data that addressed research question one on the experiences of inclusion teachers with using iPads in a middle school math inclusion class. I made each teacher aware that the interviews were recorded and that only I would have access to the audio tapes. I also informed them that the tapes would be put in a cabinet in my house under lock and key according to the university requirements. I used an iPhone to audio record the interview responses. At the same time, I took notes

during the recordings, transcribing, and coding of the preliminary interview responses. This allowed me to formulate questions that sought clarification on technology integration concepts, and teacher experiences with using iPads. After transcribing preliminary interview responses, I did member checking for credibility and made appointments for follow-up interviews.

Teacher Follow-Up Interviews

During the interview recordings and notetaking in the preliminary interviews, I listed some follow-up questions on my notes. I also listed follow-up questions during initial transcribing and coding of the preliminary teacher interviews. I set up follow-up interview appointments with teachers after the preliminary interviews. The purpose of the follow up interview questions was to seek clarification on some questions that arose during transcription and coding, and for elaboration on technology integration concepts that arose during the preliminary interview. Follow-up teacher interviews were on October 9 after school in the individual teachers' respective rooms. The follow-up teacher interviews were on the third week of the study during the same times and at the same locations as in preliminary interviews.

The follow-up interview with the general education teacher, Mr. Peters, lasted 60 minutes while the follow-up interview with the special education teacher, Mr. Williams, lasted 40 minutes. The follow-up interview questions sought to seek clarity on teachers' knowledge about the iPad as a form of assistive technology that can be a tool of accommodating student learning. The questions also sought to seek clarity on the teachers' experiences about differentiating instruction while using the iPad to meet

individual students' learning needs and the learning needs of different classes. Another main follow-up interview question sought to understand how the iPad apps support student learning in word problem assignments.

Lesson Observations

I did lesson observations from the beginning to the end of class time in week one, two, and three of the study. Class one and class two used the same classroom but at different times. For each of the three lesson observations in each class, I used the lesson observation instrument (Appendix C) to document the observed teacher and student activities during iPad-use in the math inclusion classes to capture their experiences with iPad-use. I wrote field notes to help me describe the experiences of both teachers and students with using iPads.

Student Interviews

I interviewed individual students between September 27 and October 3, 2018. Before the interview, I summarized the reason for conducting the study, students' rights, and confidentiality statements. I informed the interviewees that interviews were audio-recorded using an iPhone to capture every word that the interviewees said. I also informed interviews that I was going to be taking notes during the interview recordings.

Ariana was interviewed on September 27 after school because she chose to be interviewed at that time while she was waiting for parent pick-up. The interview lasted for 40 minutes. Bianca was also interviewed on September 27 before school started because her parent dropped her one hour early every day. The interview lasted 40 minutes. Cathy chose to be interviewed on September 28 before school hours because her

parent was going to pick her up for another appointment later in the day. The interview lasted 53 minutes. Daneshia was interviewed on October 1for 45 minutes before school hours because she was going to leave school before the end of the school day. Enrique was interviewed on October 2 after school hours for 45 minutes. Francisco was interviewed also on October 2 during lunch time. He chose to be interviewed during that time because he was playing sports after school. His interview lasted 35 minutes. German was interviewed on October 3. He chose to be interviewed before school hours because he always came to school early. The interview lasted 45 minutes. Finally, Harry was interviewed after school because that was his preferred time for the interview. The interview lasted 40 minutes.

Table 5

Summary of Student Interview Dates and Length of Interview

Student	Interview place	Interview date	Interview length (minutes)
Ariana	Classroom	09/27/2018	40
Bianca	Classroom	09/27/2018	40
Cathy	Classroom	09/28/2018	53
Daneshia	Classroom	10/01/2018	45
Enrique	Classroom	10/02/2018	45
Francisco	Classroom	10/02/2018	35
German	Classroom	10/03/2018	45
Harry	Classroom	10/03/2018	40

The location and times of the all interviews were chosen by student interviewees. I conducted all individual student interviews in the special education teacher's room behind closed doors either before or after school depending on students' preferences and parent arrangements to bring students.

Teacher Lesson Plans

I collected teacher lesson plans for each of the lessons observed. Mr. Peters provided all three lesson plans for the lessons taught during the three direct lesson observations. The lesson plans were the same for both classes. As described under the lesson observations section, the 8th grade Common Core standard was interpreting scatter graphs and investigating patterns of association between two quantities. From the lesson plans, I looked for sections in the lesson plans where the teacher specified what technology would be used and how it will be used. For lesson two, Mr. Peters indicated in the lesson plan section for student engagement and technology that the class was going to use the iPad app, ShowMe, for starter problems in both classes. For other activities in lesson two, Mr. Peters stated on the lesson plan that the classes were going to use the iPad app, Nearpod, for scatter graphs. For both lessons two and three, the Nearpod app was used for word problems.

Student Work Samples

I collected student work samples during each class lesson to analyze how students used the iPad apps during math learning. The student work samples were pictures of students' iPad-screens showing math problems they were working on. I analyzed the contents of student work samples by looking at student work line-by-line to understand

how iPad apps were used by students. Data collected from interviews were audio recorded using an iPhone and field notes. Data collected from lesson observation were recorded on the lesson observation protocol (Appendix C). A detailed description of content analysis of student work samples is provided in the data analysis section.

Data Analysis

The interpretative approach and cluster grouping of codes and categories (Alase, 2017) guided the preliminary phase of analyzing data collected. Understanding the experiences of inclusion math teachers and inclusion students with learning disabilities while using iPad-apps in Common Core math lessons was central. The interpretations and experiences of the participants about their encounters with using iPads was central to what I wanted to understand in this study (Maxwell, 2013). Therefore, focusing on the meaning and beliefs about iPad-use experiences identified the approach to data analysis as interpretive. I used two cycles of coding and categorizing data collected from each source of data collection.

Level 1 Data Analysis

For the first cycle of data analysis (Level I), I used line by line analysis of interview responses to create codes that emerged from each data source. I used interview responses to form gerunds for coding because using action verbs allowed me to reflect on the data and write memos during coding (Charmaz, 2008). Writing memos during the coding process enabled me to capture the comparisons and connections among codes. Coding and writing memos was an invaluable process that facilitated constant

comparisons of emerging codes during data analysis and the development and refining of categories (Charmaz, 2008).

I highlighted interviewees' phrases, and what the interviewees emphasized in their responses in addressing the concept of technology integration and the experiences of iPad-users. I used one color for each group of phrases that carried the same meaning. I used the actual words of the interviewee as in vivo codes in the first cycle of data analysis. Next, I read through the codes and identified codes that carried the same meaning and combined them to create categories. I followed this procedure for each data source of teacher interviews and student interviews. I analyzed the contents of teacher lesson plans, observation notes, and samples of student work to create codes and categories from those data sources.

Glaser and Strauss (2006) maintained that open coding may be useful when analyzing data collected through interviews, observations, and other artifacts. Open coding was useful for level I analysis of data collected through teacher interviews because it allowed for comparison of interview responses from different teacher participants to create clusters of responses that answered the question on teacher experiences. Open coding also allowed for comparison of student responses to create categories and themes that answered research question two. During open coding, data were analyzed using line-by-line analysis of interview responses (Charmaz, 2008). This method involved a close examination of each interviewees' responses to develop emerging initial codes that summarize the concept of technology integration and teacher experiences with iPad-app use for Common Core math. I coded teacher responses

separately from the students' responses to answer each research question. I also did content analysis of lesson observations, and lesson plans to answer research question one. The content analysis of lesson observations and student work samples helped answer research question two. For content analysis of lesson observations and lesson plans, I focused on apps used, teacher behaviors, and student behaviors to explore the experiences of teachers and special education students while using iPad apps during math learning.

Coding Teacher Interview Responses

First, I coded the preliminary individual teacher interviews then coded the individual follow up interviews using the line-by-lines analysis of interviewee responses to identify in vivo codes that emerged to explain the concept of technology integration in the form of iPad-apps and answer the research question on teacher experiences with the use of iPad apps. This allowed for a constant comparison analysis of emergent codes that addressed the line of inquiry as guided by the research questions to create categories and themes in level II of data analysis (Charmaz, 2008).

Preliminary teacher interview with Mr. Peters. This section includes a description analysis and coding of Mr. Peters' interview. The first three interview questions addressed Mr. Peters' years of teaching experiences in an inclusion class, grade and subject, and years of experience using iPads as instructional technology. Mr. Peters stated that he had 18 years of experience as a middle school math teacher with 8 of those years as an inclusion 8th grade math teacher. Mr. Peters indicated he had used iPads for 8 years and recently, the Chromebook and the iPad interchangeably for 1 year as instructional technology. The next two questions addressed teacher definitions of

technology integration, inclusion in mathematics, and Common Core Math Standards. Mr. Peters defined technology integration as, "technology to help students understand concepts, to make the curriculum more accessible, to differentiate for students and to make learning more engaging for students". Mr. Peters therefore believed that technology integration is a means of improving student learning experiences by increasing conceptual understanding of mathematics and differentiating learning. When asked how he defined mathematics inclusion, Mr. Peters said inclusion meant using strategies that will make the curriculum accessible for all students in his classroom and differentiating the ways of accessing the curriculum to accommodate students' learning styles.

Mr. Peters defined Common Core mathematics standards as rigorous standards that not only asked for demonstration of procedural competency of solving math problems but also required a deeper understanding of the standards by demonstration of conceptual understanding when solving real world problems. Mr. Peters also stated that the California Common Core mathematics standards required reading comprehension skills and writing abilities to justify answers to math problems. Conceptual understanding and rigor were central to Mr. Peters' understanding of the Common Core mathematics standards.

The next interview questions addressed Mr. Peters' role as the general education teacher, decisions made on choosing iPad apps, time allocation for use of the apps, and meeting individual students' needs. Mr. Peters defined his role as that for lesson planning including how technology was used in the classroom, and assessing student learning. Mr. Peters indicated that all students were expected to spend the same amount of time using

iPad apps for learning. On the decision on how to use the iPad in the classroom, Mr. Peters' response was,

> I decide what type of technology and what apps I am going to use for the lesson. It really depends on the activity for the lesson. For example, when we do graphing, I use the iPads because the iPad has a touch screen, is interactive, and is the best tool to use for the Nearpod app. When I choose to use Nearpod, students can draw lines using the touch screen. So, when I am teaching something that needs use of the touch screen, I use the iPad. If I am not using the touch screen I prefer the Chromebooks.

I asked Mr. Peters to explain what the Nearpod app was and he said,

> Nearpod is a website with an app. There are many teacher-made interactive lessons on Nearpod. I also have the ability to upload my own lesson and PDF files. I can run the learning session through the website or through the app. Students like using the app because it makes it easy to follow the lesson. Students can use the highlighting function on the app. Even when they are on Chromebook they can still get on Nearpod. I can still see their work on my teacher screen when using the iPad app or the Chromebook as well. The only thing is that if it's something that requires them to write, the Chromebook is not ideal. The iPad is more interactive, hence engaging for students because they can use their fingers to write on the touch screen. Yet, the Chromebook is limited because students have to move the cursor to move things around.

The salient words and phrases in Mr. Peters' responses for the question on teacher decisions on how to use the iPad were "depends on the lesson activity", "the iPad has a touch screen, is interactive, and is the best tool to use for the Nearpod app". On the question to elaborate on the Nearpod app, the salient phrases addressing teacher experiences with iPad apps were, "interactive lesson", "makes it easy to follow the lesson", "students can use the highlighting function on the app", "I can still see their work on my teacher screen when using the iPad app", and "The iPad is more interactive, hence engaging for students". I used these in vivo phrases to form the initial codes that answered research question one on teacher experiences with iPads, and addressed the concept of technology integration in teaching mathematics Common Core standards.

The last set of questions in the preliminary interview addressed the advantages, challenges, and recommendations for using iPad apps for 8th grade Common Core math standards. Mr. Peters stated that the advantages of using iPad-apps included making the lesson more engaging for students. He further elaborated that students liked using technology especially when student work was projected on the screen. Mr. Peters stated,

> Students of this generation like using technology and they have confidence in using it. So, when I give them a word problem on an iPad, they do it but if it is a paper and pencil activity, it takes a lot of teacher verbal prompting to get them started.

In his response, Mr. Peters alluded to the concept of digital natives when he said that "this generation likes using technology and they have confidence in using it". He also

highlighted excitement, and engagement, and seeing their work on the whiteboard as some of the experiences students have with using iPads for learning.

In answering the question on the challenges of using iPads, Mr. Peters discussed the technical problems that students face when using iPads. He highlighted the challenges as,

> It is difficult for students to switch between apps especially when they are using an app where a PDF math-word-problems document has been uploaded and they still have to write constructed responses using another app like ShowMe or Keynote. I wish that they could be able to easily write on the same interface without having to open another app. They can annotate and write comments on the PDF but they cannot write short constructed responses on the PDF because they will need more room for that. So, they have to open another app like ShowMe or Keynote for that.

Mr. Peters also pointed out another difficulty as the maintenance and management of iPads. He stated,

> Sometimes students leave the iPads not connected to the charging station and the next day several iPad batteries are low and students have to share iPads. When students share, it is difficult to know each students' levels of performance. The other difficulty is that as the teacher, I have to keep pace with updates on the iPad so that I have to update each one of the iPads in the iPad-cart. This is time consuming.

In Mr. Peters' responses regarding the advantages of using iPads, the salient phrases, sentences or words addressing technology integration and experiences of teachers with using iPad apps were, "the lesson more engaging for students", "special education students are more engaged with the iPads", "students like a lot of technology", and "they get excited when I show their work on the screen". The outstanding phrases for the disadvantages were, "iPads not connected to charging stations", "difficult to determine individual student's level of performance when sharing the iPad", "time consuming", and "keep pace with updates on the iPad". I used these phrases to create the initial emerging codes that addressed the concept of technology integration and answered the research question on inclusion math teachers' experiences with using iPad apps.

Preliminary interview with Mr. Williams. I followed the same coding procedure for Mr. Williams as I did for Mr. Peters. I read the transcript line-by-line and highlighted emerging repeated or salient phrases, sentences, or words that addressed the line of inquiry guided by the research question on teacher experiences with iPad-app-use and the conceptual framework of technology integration. The first three interview questions were on Mr. Williams' years of experience as an inclusion teacher, years of experience with using iPads as in a math class, and grade and subject taught. Mr. Williams shared that this was his 4th year of teaching an 8th grade inclusion math class and using iPads for instruction. Mr. Williams shared that he was a co-teacher for an 8th grade Common Core math class. The next group of questions were for Mr. Williams to define technology integration, define mathematics inclusion, state his role as a special education teacher, and define the Common Core standards. Mr. Williams defined

technology integration as, "any kind of device that can help a student achieve their education goals. For example, in our case we use iPads, iPad apps, Chromebook and we let the students use cell phones once in a while". When asked to elaborate on the apps that he and his co-teacher used in their math class Mr. Williams responded, "We use apps like Nearpod, IXL, ShowMe, and Keynote". To define inclusion in mathematics Mr. Williams stated,

> This is where we include special education students inside the general education classroom using Common Core standards but we also differentiate for the special needs students. So, we provide access to the curriculum for the special education students.

Mr. Williams' definition emphasized differentiation and providing access to the curriculum. The codes that emerged from the definition of inclusion in mathematics were "differentiate for special needs students", and "provide access to the curriculum." Mr. Williams stated his role in an inclusion math class as;

> I do co-teaching, and for those students who struggle during instruction, I pull them into a small group to give further support. My role is to see that they get their learning accommodations and all the necessary tools they need to have access to the math curriculum. These support students in understanding the concepts and keep them engaged. I also support other general education students that need extra support in the classroom.

Emerging codes addressing the concept of technology integration from the interview question on the role of the special education inclusion teacher were "learning

accommodations", "necessary tools to have access to the math curriculum", "keeping students engaged", and "support understanding of concepts". To define the Common Core standards Mr. Williams highlighted Common Core state standards as standards that, "all math students must meet."

The next three questions sought to understand decisions on iPad-use in a math inclusion class. Mr. Williams' response to the question was,

> The decision on how to use iPads depends on what the lesson is about. Students do not decide what apps to use. Unless it is written in their IEP that they need a specific type of technology, they would use that technology according to what they IEP says. However, currently in our two math classes, special education students use the iPads in the same way the general education students use them and they are all given the same amount of time.

Mr. Williams' response yielded these codes, "depends on what the lesson is about", "students do not decide what apps to use", "using iPads in the same way", and "using technology according to what they IEP says." On responding to the question on time allocated to the use of iPads, Mr. Williams reiterated that it depended on the lesson activity. He also shared that if the lesson activity did not require use of the touch screen that the iPad provides, they used the Chromebook.

I asked Mr. Williams if iPad-use for math learning helped to meet special education students' individual learning needs. Mr. Williams' response was,

> Yes, we meet individual students' needs. Use of iPad apps allow students to access the curriculum. It gives them visuals and they can use the iPads as

> responders for quick assessments and we can get an instant feedback on the accuracy of their responses.

I identified emerging codes as the phrases, "meeting individual students' needs", "allowing students to access the curriculum", "giving visuals", "use iPads as responders for quick assessments", and "instant feedback" in reference to technology integration and the experiences of teachers with iPad-use. Mr. Williams' response to the question on the advantages of using iPads was,

> Again, the iPad gives students visuals of learning materials. They are also a quick way of accessing learning material. They are tools for assessment and we can quickly check for understanding when students use the responders to answer questions and we see their responses projected on the whiteboard. Students love to see their scores projected on the smartboard. It keeps them engaged.

The salient phrases in Mr. Williams' response addressing technology integration and teacher experiences were, "gives visuals of learning materials", "a quick way of accessing learning material", "tools for assessment", and "checking for understanding." Mr. Williams shared the disadvantages as,

> Sometimes the lesson activity requires something different from what the iPad is capable of. We can use keynote for writing but sometimes, it depends on the students, sometimes students feel better manually writing things down.

Mr. Williams highlighted the disadvantages as, "students feeling better manually writing things down", "students leaving iPads uncharged", and "updating the iPads and keep up with new apps that come up every day"

The next three questions were on iPad reports for instructional planning, use of iPad data, and documentation of iPad-use in lesson plans. Mr. Williams stated,

> We can quickly see right on the smartboard students' performance on a quiz, or short responses and we can quickly evaluate their performance on the learning material. We do it weekly, and occasionally we do short responses during the lesson to check for understanding. Depending on student performance, we use the data to go back and go over the lesson or reteach. The iPad reports give us a quick overview of whether students are meeting their math goals. Students love to see their work projected on the screen and they get engaged.

The codes that emerged with reference to teacher experiences and technology integration in the form of iPads were, "quickly evaluating students' performance", "checking for understanding", "re-teaching", "quick overview of whether students are meeting their math goals," and "students get engaged". Mr. Williams gave the following recommendations for iPad-use in an inclusion math class, "frequently update iPads", "consider students' needs when choosing apps", and "give special education students extra time to use iPads in completing assignment".

Table 6 below is a summary of the in vivo codes that emerged from Mr. Peters and Mr. Williams' preliminary interviews. The codes emerged by combining phrases from both teachers that carried the same meaning and answered research question one on teacher experiences with iPads. The codes also emerged from teacher responses that addressed the concept of technology integration.

Table 6

Summary of Teacher Preliminary Interview Responses

Mr. Peters	Mr. Williams
Using iPad or any form of technology IPad-apps engaging students Students accessing rigorous learning materials Students experiencing Common Core standards-based state testing on Nearpod, Kahoot and IXL	Students gaining confidence IPad-apps engaging students Students demonstrating a deeper understanding of math concepts using apps Using apps to access rigorous curriculum Using IPads as assessment tools

The comparative presentation of the codes emerging from the individual preliminary teacher interviews enabled me to group codes that carry the same meaning related to technology integration and teacher experiences. As shown on table 6, Mr. Peters demonstrated awareness that technology integration could mean using any form of technology as a means to meeting lesson objectives. Mr. Peters identified Kahoot, Nearpod, and IXL as iPad apps used as technology that provided rigorous Common Core standards-based learning material. Similarly, codes emerging from Mr. Williams interview responses addressed the concept of technology integration as use of apps that enabled students to access the rigorous curriculum and demonstrating deeper understanding of math concepts. Student engagement, and student improved experiences with math learning were common codes emerging from both teachers' interview responses.

Yin's (2014) guidelines on conducting interviews included creating interview questions that follow the line of inquiry as guided by the research questions. I used these

guidelines to create follow-up interview questions. Using the emerging codes that addressed the concept of technology integration and teacher experiences, I developed follow-up questions to seek clarification on some of the teachers' responses. Follow up interview questions sought to get clarification on what teachers meant by student engagement, and comparing use of iPad-apps with "any form of technology" referenced in the preliminary interview. Follow-up interview questions also sought elaborating on the concept of technology integration in terms of explaining use of apps like IXL, elaborating on "accessing the curriculum", and explaining "students better understanding math concepts". The follow-up questions sought clarification on concepts and ideas mentioned in the preliminary interviews that would further answer the research question on teacher experiences with iPad-app-use for the Common Core math curriculum in relation to the concept of technology integration.

Follow-up interview with Mr. Peters. I asked Mr. Peters to elaborate on student engagement by stating,

> When we use the iPad or any other technology like the Chromebook, students are more willing to work than if I give a paper and pencil assignment. When it's paper and pencil, I have to use a lot of verbal prompting to keep them working or even to get started. In our school, we use the Positive Behavior Intervention Support system by teaching social skills including staying on task, and minding your own business among others. I have about 8 students with special needs in each of my 8th grade classes. Most of these students tend to exhibit off task behaviors and disrupt learning with these behaviors. I have noticed that when I

use any form of technology, there is a big difference in these students' behaviors. They are calmer, focused, participate in the learning activities, and stay on task.

Several codes addressing technology integration and teacher experiences emerged from Mr. Peters' response. I used the in vivo method to identify codes emerging from Mr. Peters' responses including, "technology integration is using iPads or any other form of technology", "students willing to work than when given paper and pencil assignment", "students are calmer, focused, participate in learning activities, and stay on task when using any form of technology". When I asked Mr. Peters to compare iPad-app-use for math learning to other forms of technology that he mentioned in the preliminary interview, he said,

> It really depends on the lesson planning, learning objectives, and learning activities for a particular lesson. In general, students love technology and they don't want to do paper and pencil work because they are exposed to technology in their everyday lives. So, as long as it is technology that they enjoy using, they will do the work. Sometimes I make the whole class use Chromebooks if there is a lot of writing required in the lesson. For example, short constructed responses can be easily typed on the Chromebook than the iPad. Sometimes I even ask them to use their cellphones. For example, when I want to do a quick assessment to check for understanding, I ask students to pull out their cellphones to take a quick quiz on Kahoot. Of course, they also do use the iPad to take quizzes on Kahoot and Nearpod. So, I am really flexible with what technology I use in my classroom.

The highlights of Mr. Peters responses were “depends on lesson planning learning objectives, and learning activities for a particular lesson”, “students love technology”, “they are exposed to technology in their everyday lives”, “as long as it is technology that they enjoy using”, “short constructed responses can be easily typed on the Chromebook”, “cellphones to take a quick quiz on Kahoot”, ‘use iPads to take quizzes on Kahoot and Nearpod”, and “flexible with what technology I use”.

In the preliminary interview, Mr. Peters said that iPad apps allowed students to access the curriculum. In the follow-up interview, I asked him to elaborate on accessing the curriculum. Mr. Peters said, “Nearpod in particular has lessons already uploaded and I just have to choose the one that meets our learning goal”. He further elaborated,

> Students are able to get all the learning material already uploaded so I do not have to determine their pace. For example, I would determine their pace when I have to project each problem on the whiteboard for them. However, it is crucial for me to be able to choose learning activities that are rigorous to meet the expectations of the standards. Sometimes I have to upload supplementary activities to bring in that rigor. The other thing about using the apps such as Nearpod and IXL they give students the experience they need for the Common Core standards-based state testing.

I asked Mr. Peters to explain IXL and he said that it is a website with an app. He elaborated that IXL is derived from the phrase “I excel”. Mr. Peters said that the use of IXL is subscription-based and students get practice questions from thousands of math topics. I created the following codes from Mr. Peters’ responses, “students get all

learning materials uploaded", "individual pace", "choose learning activities that are rigorous to meet the expectations of the standards", "upload rigorous supplementary activities", "Nearpod", "IXL" and "experience needed for the Common Core standards-based state testing".

Finally, I asked Mr. Peters to explain what he meant in the preliminary interview when he said using iPad-apps helps students better understand math concepts. Mr. Peters said, "Students can watch videos, see pictures, and do projects uploaded on Nearpod". He further added, "Such learning experiences bring abstract concepts to life that students would not generally understand if they just had to do paper and pencil practice problems". The salient phrases in his response were, "watch videos, see pictures, and do projects uploaded on Nearpod", and "bringing abstract concepts to life".

Follow-up interview with Mr. Williams. Mr. Williams' response to the question on determining how students are engaged was,

> Most of those special education students you observed cannot stay on task and pay attention to the end of the lesson if they are not using the iPad, Chromebook, or their cellphone. So, I would say that when I see them sitting down and focusing on their work, staying on task and completing assignments when using any of the technologies, they are engaged. You saw it the other day. They were volunteering their work to be displayed on the whiteboard for feedback from their peers. It looks like technology boosts their confidence. I see that they also tend to perform better on assignments done on iPads or Chromebooks than assignments done on paper and pencil.

The in vivo codes that emerged addressing technology integration and teachers' experiences with iPad-app-use were, "students cannot stay on task and pay attention to the end of the lesson if not using the iPad, Chromebook, or their cellphone", "focusing on their work, staying on task and completing assignments when using any of the technologies", "engaged", "volunteering to have work projected on whiteboard", "technology boosts confidence", and "students tend to perform better on assignments done on iPads or Chromebooks than assignments done on paper and pencil".

I asked Mr. Williams about his opinion on use of iPads compared to the other technologies that he mentioned in the preliminary interview. Mr. Williams' reaction to the question was that "each technology had its own advantage", and that, "the lesson objectives determined the type of technology to be used". On the iPad he stated,

> We have been using iPads for a while now. For me, it has been for 4 years and I am now comfortable using it compared to the Chromebook. I have not yet mastered the use of the Chromebook like I know how to get the apps I need on an iPad.

Mr. Williams said that iPad apps allowed students to access the general curriculum, and enhanced students' understanding of math concepts,

> Like I said in the first interview about the Common Core standards, there is need for students to demonstrate a deeper understanding of and ability to apply math concepts, for example by using math skills to solve real world problems. So, in some math apps like Nearpod, there are rigors activities that require students to use their mathematics skills in solving complex problems. The ability to access

rigorous lesson uploaded by any teacher on Nearpod, explains why use of apps enables students to access the curriculum.

I used Mr. Williams' outstanding phrases that answered the research question on teacher experiences as emerging codes. The emerging codes included, "Using the iPad is comfortable than using the Chromebook", "students demonstrating a deeper understanding of math concepts", "using math skills to solve real world problems", "accessing rigorous math activities in math apps like Nearpod", and "Accessing rigorous lesson uploaded by any teacher on Nearpod". Table 7 below summarizes the codes created from Mr. Peters and Mr. Williams using the follow-up interviews.

Table 7

Summary of in Vivo Codes From Teacher Follow-Up Interview Responses

Mr. Peters	Mr. Williams
Using iPad or any technology	Volunteering work to be projected on whiteboard
iPad-use depending on learning objectives	Technology boosting students' confidence
Students willing to work	Students demonstrating a deeper understanding of math concepts
Students taking quizzes on Kahoot and Nearpod	Using math skills to solve real world problems
Teachers being flexible with technology-use.	Accessing rigorous lessons uploaded by any teacher on Nearpod
Accessing lessons uploaded on Nearpod	Students comfortable using the iPad
Choosing apps that meet learning goal	
Choosing rigorous learning activities	
Nearpod and IXL giving students the experience of the Common Core standards-based state testing	

The emerging in vivo codes from both teacher follow-up interview responses alluded to the preliminary responses. Both teachers reiterated that they witnessed student engagement during iPad-use for Common core standards-based word problems. Both teachers identified Nearpod as one of the apps that provided rigorous learning material to

students. While Mr. Peters stated that students with math learning disabilities had access to rigorous supplementary math activities on iPad apps, Mr. Williams maintained that special education students use their basic math skills to solve real world problems accessed on iPad apps. Mr. Williams further pointed out that students were comfortable using technology in the form of iPads and have demonstrated a deeper understanding of math concepts. In addressing the concept of technology integration, the emerging codes from Mr. Peters' responses were, "using iPads or any technology", "using the iPads depended on the learning objective", "using the iPads to take quizzes on Kahoot and Nearpod", "flexible technology use", "using cellphones to take quizzes on Kahoot", and "writing constructed responses". Unlike Mr. Williams emerging codes that zeroed on witnessed student engagement and experiences with iPad-app use, Mr. Peters' responses also addressed the concept of technology integration as a flexible phenomenon. Mr. Peters' emergent in vivo codes listed above describe teacher experiences with use of iPads as largely influenced by the learning objectives. Therefore, teachers chose to use iPad apps where they were necessary as a means to meeting learning objectives.

To create categories, I compared the emergent codes (table 6) and memos from preliminary teacher interviews and the codes from the follow-up interviews (table 7). I combined codes that carried the same meaning to create categories summarized on table 8 below.

Table 8

Categories Created From Teacher Interview Codes

Categories	Codes
Student engagement	IPad-apps engaging special education students Students willing to work Students focusing and completing assignments when using any of the technologies, Volunteering work to be projected on whiteboard
Assistive technology	IPads having a touch screen Using iPads as responders for quick assessments Using iPad or any technology Students watching videos, and doing projects Technology boosting students' confidence Nearpod providing visuals for learning materials Writing constructed responses
Assessment tool	IPad-app giving instant feedback IPad apps providing tools for assessment Checking for understanding Giving a quick assessment of whether students are meeting their math goals
Instructional planning	Choice of apps depends on the lesson objectives Learning accommodations Nearpod and IXL give students the experience of the Common Core standards-based state testing Accessing rigorous lesson uploaded on Nearpod Using math skills to solve real world problems Students tending to perform better on assignments done on iPads or Chromebooks
Challenges	Time consuming Keeping pace with updates on the iPad Students feeling better writing things manually Students leaving iPads not charged Not knowing how to use text-to-speech

The categories on table 9 created from grouping codes into clusters with the same meaning were student engagement, assistive technology, assessment tool, instructional planning tool, challenges, and recommendations. Therefore, both teachers' experiences included witnessing student engagement, using iPad apps as assistive technology and

assessment tool, and planning for the use of iPads by choosing apps that were appropriate to provides the means of meeting learning objectives. Both teachers encountered challenges including keeping pace with updates on iPads, not knowing how to use the text-to-speech iPad function, and experiencing iPads left not charged.

Coding Individual Student Interview Responses

After conducting student interviews, I immediately transcribed the audio tapes. Before analyzing the data, I did member checking using the transcripts for credibility. To analyze the data, I highlighted emerging codes using line-by-line analysis of each student's responses. I identified codes as repeated phrases, outstanding words, or sentences that addressed the concept of technology integration and answered the research question on student experiences with iPad-app-use. Next, I grouped occurring codes among student responses into categories.

Ariana. Ariana shared that she had been using iPad apps for learning for 2 years and that in her 8th grade class, she used iPads about two times a week. I asked Ariana if she wanted to increase or decrease iPad-use time and to explain her answer. Her response was,

> Increase the time for using the iPads. It's easier to use iPads instead of writing using free hand. With the iPad, you just type the answer in. In Nearpod, graphs are already there and you just have to tap on the intercepts because you can just see it on the graph. Also, we don't get distracted.

Ariana's response underscored the functionality of the iPad. I coded outstanding phrases that answered research question two on student experiences as, "increase the time for

using iPads", "it's easier to use iPads", "we don't get distracted", and "graphs are already there and you just have to tap on the intercepts".

The next group of questions sought to collect data on decisions made about iPad-use. One of the questions asked whether there was differentiation in the length of time and the manner in which the iPads were used. Ariana's response was that students spent the same amount of time on apps that were chosen by the teacher. Ariana elaborated that students were free to use different features that came with the app. She specifically referred to the Nearpod app that had a highlighting feature. Using the interpretive approach, I coded this response as, "minimal differentiation in time allocation and app choice" to answer the question on student experiences.

The next two questions asked how students used the iPad apps for math learning, and how the inclusion teachers worked with students during iPad-use. Ariana responded,

> We go to Nearpod, it is easier that way than using paper. On Nearpod we can follow a lesson that is already uploaded. We can take a quiz and see our scores immediately. I don't know the other apps' names. The teacher tells us where to go and when its individual work, if we don't understand the problems we just raise our hand then he comes and help us.

The codes that emerged from what Ariana response addressing the concept of technology integration were, "Nearpod app", "easier than using paper", "quizzes on Nearpod app", "immediate feedback", and "teacher help".

On the question about what she liked about using the iPad, Ariana stated, "the iPad is easier because I can just tap". When asked to elaborate on what she meant by just

tapping, Ariana maintained that she could just use the touch screen of the iPad to select answer choices instead of writing them down. She added that she could also drag answers to boxes, use her hand or a stylus pen to draw lines, and use the highlighting function. I coded her explanation as "interactive iPad touch screen". On the challenges of using the iPad, Ariana shared that sometimes students mess around with the settings. I asked Ariana what she would suggest for teachers to improve use of iPads as a learning tool and her answer was, "I don't know".

Bianca. On the first two student interview questions about years of experience using with the iPad, and how many times per week students used iPads in the math class, Bianca said she had 3 years of experience using the iPad in a math class. She also shared that in her math class, they used iPad apps two times a week. The next two questions asked whether Bianca wanted an increase or decrease in the amount of time for iPad-app-use in her math class, and whether students used the same apps for the same amount of time in a given lesson. Bianca said,

> I wish they can increase the time we use iPads because they are easier to use than writing on paper. Sometimes our fingers hurt when writing. Sometimes Nearpod app gives us graphs and we just need to use those graphs to answer questions.

The salient phrases in Bianca's responses answering the inquiry on technology integration and student experiences with iPad-use were, "used iPad apps two times a week", "increase the time we use iPads", "they are easier to use than writing on paper", and "Nearpod app gives us graphs." Bianca also mentioned that students use the same apps in a given lesson and for the same amount of time, but students can use different

functions that come with the app. I coded this as, “minimal differentiation with use of apps” to address how technology in the form of iPad apps is used in a Common Core math inclusion class.

The next three questions were on the decisions made about iPad-app-use, whether students make decisions on what apps to use, the length of time using the apps, and how the iPad is used in the math class. Bianca stated, “Students do not choose the apps. My teachers tell us what apps to use for each lesson”. On the length of time to use the iPad, Bianca said, “My teacher gives us enough time to finish the problems. He puts a timer on the board and we do our work looking at the given time.” When asked how she used the iPad in her math class, Bianca said, “We go on Nearpod, that is all I remember.” The codes I created using Bianca’s responses were, “students do not choose the apps”, “use of a timer”, “Nearpod app”. The next question was on how the teachers worked with students during iPad-use time. Bianca’s response was, “We just have to raise our hand to get individual help from the teacher. They always come to help us when we are confused”. I coded this as “individual help from the teacher”.

The last three questions were on what Bianca liked about using iPads in her math class, the challenges she faced, and recommendations for teachers to improve the way iPads are used in her math class. On the question about what she liked about using the iPad in her math class, Bianca stated,

> I hate writing using paper and pencil, so using the iPad is easier because it is more engaging. I can write using my figure, and I can also use a stylus pen on the screen. This is more fun than using a paper and pencil.

The emerging codes answering the research question on student experiences were, "the iPad is easier to use", "more engaging", and "fun". On challenges that Bianca faced using iPads, her response was, "Sometimes the internet does not work, and sometimes iPads have a dead battery". On recommendations Bianca's response was, "Give us more time and let us take the iPad home". I coded Bianca's responses as "internet not working", "sometimes iPads have a dead battery", "give students more time", and "let students take the iPads home".

Cathy. On the first two questions regarding years of experience using iPads in a math class, and how often Cathy used iPads in her math class, Cathy stated she had 4 years of experience with iPads in a math class, and she used iPads two times a week in her 8th grade math class. The next two questions were on whether Cathy would like an increase or decrease in the amount of time given for iPad-app-use in her math class, and whether students used the same apps over the same amount of time during a math lesson. Cathy's response was,

> I would say definitely increase the amount of time we use the apps because sometimes some of us struggle with getting the iPad to work because sometimes the iPad battery is dead, or the internet is slow. Before we are even half-way through doing the math problems, the time is up.

Cathy also shared that students use the same apps over the same teacher-given time. The codes I created for this response were, "increase the amount of time for using apps", "some of us struggle with getting the iPad to work", "iPad battery is dead", "the internet is slow", and "Before we are even half-way through doing the math problems, time is

up". On the questions about decisions on what apps to use and how to use the apps, Cathy's response was,

> The teachers decide what apps to use depending on the lesson and sometimes we do not use the iPad but the teachers give us the Chromebook, or even make us use our cellphones as responders for Kahoot.

I asked Cathy to explain Kahoot and she said it was online learning games where students can take game-based quizzes using their cellphones or iPads to make answer choices and their performance was projected on the whiteboard. On the question about how Cathy used the iPad for math learning, her response was,

> The teacher tells us to go on Nearpod most of the times and we find the lesson there and all we do is do the lesson activities. It's fun though because we get to see our work displayed on the whiteboard.

From Cathy's responses, the emerging codes on the concept of technology integration and student experiences with iPad-app use were, "teachers decide what apps to use", "use of Chromebook", "Nearpod app", "fun", and "work displayed on whiteboard". On the question about how the teachers worked with Cathy during iPad-use time, Cathy stated, "All I need to do is raise my hand to show that I need help and any of my teachers comes to work with me". The code that emerged addressing how technology in the form of iPad was used was, "individual support."

In response to the questions about what Cathy liked about using the iPad in math learning, and the challenges she faced, Cathy said that iPad apps for math learning made her to "pay attention in class and stay on task to do all my work because it's fun to use

the apps". I coded this as "paying attention in class" and "fun". On her challenges with using the iPad apps for math learning Cathy said,

> Most of the times the battery is dead because someone did not plug the iPad to charge and this frustrates me because I have to get up and look for another iPad while others are continuing with their work.

Cathy further stated, "sometimes everybody in the school is on the internet and the internet becomes very slow". For recommendations on iPad-use, Cathy shared, "My teachers are really good with the apps that they give us. I don't have anything I want them to improve". From these responses, the emerging codes on student experiences were, "dead battery", "frustrating", "slow internet", and "teachers are good with choice of apps",

Daneshia. On the first two questions Daneshia said she had 4 years of experience using iPads as a tool for learning, and that in her 8th grade math class she uses iPads at least two times a week. On the next two questions asking Daneshia if she would like an increase or decrease in the amount of time given to use the iPad in her math class, her response was,

> I would really be nice if our teacher lets us use the iPad every day instead of two times a week because the apps we use for math make learning interesting and we don't get distracted like we do when we use just papers and pencils.

Daneshia also shared that the teachers give all students the same apps to use over the same amount of time. From these responses, I coded, "use iPad everyday", "math apps

make learning interesting", and "less distractions". In response to the questions about the decisions on apps and time allocated for app-use, Daneshia said,

> Our teachers tell us which app we are using for each lesson and they give us timed activities. Sometimes I finish my work during the given time, but there are times I wish I could take the iPad home to complete my assignment.

On how she uses the iPad in her math class, Daneshia's response was,

> When we use the Nearpod app, I can highlight things. I like to highlight because it makes it easy for me to focus only on the important stuff necessary for me to understand the math concepts we are learning. I can use my finger to write on the touch screen, and I can immediately get my score on some quizzes. Using iPads is really fun because I hate listening to the teacher's voice all the time. I can ask my classmates for help if I need it.

The emerging codes from this response were, "teachers choose apps", "Nearpod app", "ability to highlight", "writing on the touch screen", "immediate feedback", "using iPads is fun", and "asking classmates for help". These codes were a description of student experiences with iPad-apps to answer research question two. On how the teachers worked with students during iPad-use time Daneshia said that the procedure for asking for help in her math class was to raise a hand.

The last three questions were on what Daneshia liked about using iPads for math learning, the challenges she faced, and recommendations she would give to her teacher to improve using iPads for math learning. Daneshia mentioned that the advantages of using

iPads were, “getting all the learning activities for the lesson on the Nearpod app”. She further said, “we can easily work with others while using our own screens”. I asked Daneshia to elaborate on working with others and she stated that she was able to seek for help from her peers even when she was doing individual work on her own iPad. Daneshia further elaborated, “we can also give each other feedback on each other’s work when our work is projected on the whiteboard”. The emerging codes on this response were, “accessing learning materials on Nearpod”, collaborating with peers”, and “giving peer feedback”.

On the disadvantages of using iPads, Daneshia’s response was,

> I think iPads are getting old and we are getting tired of them. They just gave us the Chromebook and I think I like seeing my work on a bigger screen now. The iPads give teachers a lot of work when they have to sit down an update all of them and make sure they are charged. Anyways the iPad is getting out of fashion, I just want to use new technologies.

The in vivo codes in Daneshia’s response were, “iPads are getting old”, “getting tired of iPads”, “iPads giving teachers a lot of work”, “the iPad is getting out of fashion”, and “wanting to use new technology”. Daneshia shared that she did not have suggestions to improve the ways she used iPads for math learning. These codes gave insight on student experiences with iPad-use in math learning.

Enrique. Enrique shared that he had 5 years of experience using iPads for math learning. He said that at the time of the interview he was using iPads for at least two times per week. On the question on whether he would like the frequency of using iPads in

his math class increased or decreased, Enrique mentioned that he would like to use the iPad "more frequently". The next question sought to understand whether time for iPad-use was differentiated for special education students in math inclusion classrooms. Enrique answer was, "we all use the iPad at the same time. The teacher puts a timer and when it goes off we all stop." I coded Enrique's responses for the first four questions as, "two times per week", "more frequently", "same amount of iPad", "teacher use of a timer".

The next three questions were on student and teacher decisions on iPad-use, and how iPads were used in the math inclusion class. Enrique shared that students did not make any decisions about what apps to use for the lesson. His response was,

> The teachers just tell us which apps we are using today. We usually use Nearpod where we do all our work and then we review the work together. Nearpod makes it easy to complete our assignments because the videos and pictures make it easy to understand math. The teacher projects all our work on the whiteboard and we give feedback on each other's work. Sometimes we use Kahoot and take quizzes. I like this one because it is fun and it does not give us stress. We take the quiz as a game.

On the question about how the teacher worked with Enrique during iPad-use time of the lesson, Enrique's response was "the teacher always comes to help me whenever I need help. I just raise my hand to get his attention". I identified in vivo codes as, "teachers choose apps", "using Nearpod", "reviewing work together", "giving feedback on each other's work", "use Kahoot to take quizzes", "fun", "no stress", "taking the quiz as a

game", "getting help from the teacher", and "raising hand to get teacher's attention". These codes described the experiences of inclusion special education students with use of iPad-apps for math learning.

The last three questions were on the advantages, challenges, and recommendations for using iPads in an inclusion math class. Enrique shared this about the advantages of using iPad-apps in his math class,

> The Nearpod is easy to use because we can highlight, underline, circle, and have our work shown on the screen for other students to give us feedback. Learning is fun that way. We also tend to stay on task when using the iPad apps than when working on worksheets. Students are really engaged.

The emerging codes this as "Nearpod is easy to use", "highlighting, underlining, circling", "feedback", "staying on task", "engagement", and "learning is fun". Enrique's response on the disadvantages of using iPads included, "iPads not charged", "slow internet", "students change settings", and "we can't take the iPad home". Enrique also added that he was happy that the school was giving them the Chromebook and they could take it home. Enrique's recommendation for iPad-use in a math inclusion class was, "give us more time to use the iPad so we can finish our work."

Francisco. Francisco shared it was his first year using iPads for math learning. He said he used iPads at least two times per week in his math class. Francisco also mentioned he would like an "increase" in the amount of time of using iPads for math learning. He further stated, "but I now prefer using the Chromebook because of too many problems with the iPad". I asked Francisco to elaborate on the problems with the iPad.

He said, “sometimes when my class comes in, some of the iPads are not charged and sometimes some students mess around with the iPads.” I asked Francisco to explain what he meant by students messing around with the iPads and he said, “students change the settings”. Francisco’s response to the time students spent using the iPad-apps during a lesson, he shared that the teacher uses a timer “that lets us all know when to stop working on the iPad”. I asked Francisco whether he gets extra time on the iPad. His response was that all students are given the same amount of time to use the app chosen by the teacher. The next question was on how Francisco used the iPad in his math class. His response was, “We go on Nearpod by simple tapping on the app and then solve the math problems on Nearpod. I like that we can highlight stuff. This makes learning easier and less stressful”.

I coded Francisco’s responses as, “two times per week”, “increase amount of time using iPads”, “prefer using the Chromebook”, “too many problems with the iPad”, “iPads not charged”, “students change settings”, “use of a timer”, “same amount of time for iPad-use”, “solve math problems on Nearpod”, “highlighting”, and “makes learning easier and less stressful”.

The last three interview questions were on the advantages, disadvantages, and recommendations for using iPads in a math inclusion class. Francisco’s response for the advantages was,

> I like using the iPad because there are cool apps that keeps us engaged. They are fun to use. On Nearpod, sometimes graphs are already provided for the lesson and all we have to do is look for and tap on the touch screen to identify the x and y

> intercepts. This is easy. I like the quizzes on Kahoot because it's a game and I like seeing our performance immediately projected on the screen.

I coded this response as, "prefer using the iPad", "engaging apps", "apps are fun to use", "tap on the touch screen to identify the x and y axis", "quizzes on Kahoot", and "immediate feedback". On the question about the disadvantages of using iPads, Francisco stated, "sometimes iPads are not charged and sometimes the internet is slow." He added that iPads need to be updated every time. Francisco's recommendation for iPad-use in a math inclusion classroom was, "teachers should allow us to take the iPads home so that we can continue working while at home."

German. On years of experience using iPads in a math class, German said it was his first year of using iPads for math learning and that he used it at least two times per week. On the question about the frequency of iPad-use, German mentioned that he would like it to be "increased because we learn better when using iPads. It is more fun and engaging than when we use paper and pencil". The next question sought to understand differentiation in iPad-use. German's response was, "we all use the same apps that the teachers give us and then when the timer you saw on the screen goes off, we stop and go on to the next activity." Codes addressing technology integration and student experiences with iPads emerging from German's responses to the first four questions were, "two times per week", "increase frequency of iPad-use", "students learn better when using iPads", "fun and engaging", and "using the same apps".

The next four questions sought to understand the decisions made by teachers and students when using iPads, how the iPads are used, and how the teachers work with

students during iPad-use. German's response was that teachers decided what apps to use and how much time to spend on the apps for each lesson. On getting help from the teacher, German said, "I just raise my hand and this tells the teachers that I need help and one of the teachers always comes to work with me". To describe how iPads are used in his class German said,

> It really depends on the lesson. Sometimes the teachers tell us to use Nearpod because we have to access a certain activity that is already uploaded on Nearpod. On other days, we use different kinds of apps. For example, we use ShowMe if we are doing practice problems and the teacher wants to see how much we understand what we are learning. Some days we go on Kahoot to take quiz as individuals and sometimes as groups. I like it when we do group quiz on Kahoot because it becomes a competition with other groups and we learn better while we have fun. We don't get distracted because we will be enjoying learning.

The following are the codes that emerged from German's responses, "teachers decided what apps to use", "teachers decided the time spent on iPads", "teachers help", "use of apps depends on the lesson", "Nearpod app gives access to activity that is already uploaded", "using different kinds of apps", "ShowMe", "Kahoot", "fun", and "no distraction". These codes addressed the concept of technology integration and student experiences with iPad-use in math.

I asked German about the advantages and disadvantages of using the iPad for math learning in an inclusion Common Core math class as well as his recommendation on how to improve use of iPads for learning. The salient phrases describing student

experiences to answer research question two in German's responses were, "the touch screen makes it easy to use the technology for learning", "getting feedback instantly", "collaborating with peers", "getting one-on-one teacher help", and "getting engaged because it's fun, and not getting distracted". German stated the disadvantages as, "dead batteries", "iPads have to be updated frequently", "students changing settings", and "getting the Chromebook which is easier to use and we can take it home with us". German gave this recommendation about using the iPad for learning in his class, "the iPads are getting old and they give teachers a lot of work to maintain, let us just use the Chromebook because we can still access Nearpod on Chromebook".

Harry. Harry shared that he had four years of experience with using the iPad and that he used the iPad at least two times per week in his classroom. His response to the question about whether he wanted the frequency of iPad-use to increase or decrease he said;

> I really don't care whether we are using the iPad or the Chromebook, but yes, we should increase use of technology in math. As long as we use some kind of technology to keep us engaged because sometimes learning is really boring if it is just the teacher talking all the time.

The codes emerging from Harry's responses were, "at least two times per week", "increase technology use", "no preference between iPad and Chromebook", and "students engaged". On the question about differentiation, Harry shared that students used the same apps given by the teachers but there was room for students to choose how they used the

app. For example, “some students may choose to use the highlighting function, while other may just underline”.

On the questions about the advantages and disadvantages of using iPads, and the recommendations for improving the ways iPads are used for math learning in a common core math class Harry said;

> The iPad does not have a keyboard like the Chromebook so it becomes difficult to type question like one would do when using a keyboard. Also, iPads have to be updated frequently, and charged all the time. Sometimes students leave the iPads disconnected from the cart and the battery dies.

I asked what the advantages of using the iPad were and he said, “I like tapping on the touch screen, and I like the iPad because you can easily carry it around the classroom”. The codes that emerged here were, “the touch screen”, “easy to carry”, and “no keyboard like the Chromebook”, “difficult to type using iPad”, “updated frequently”, and “students leave the iPads disconnected from the cart and the battery dies”. Harry’s recommendation for iPad-use was, “Let’s start using the Chromebook that we just received so that we can type the writing assignments. Also, we can download the android apps to the Chromebook so we really don’t have to use the old iPads”. Codes that emerged were “start using the Chromebook frequently” and “ability to download apps to the Chromebook”. These codes did not answer the research question on student experiences with iPad-app use but helped to give an insight on what some students thought about technology integration in a Common Core math class, that it is not limited to iPads. Table

9 is a summary of the in vivo codes from student's responses that answered research question two and addressed the concept of technology integration.

Table 9
Summary of codes from student interviews

Codes	Ariana	Bianca	Cathy	Daneshia	Enrique	Francisco	German	Harry
Staying on task	x	x	x	x	x	x	x	x
Makes learning fun	x	x	x	x			x	
Completing assignments	x	x	x	x	x	x	x	
Nearpod easier than using worksheets	x	x	x	x	x	x	x	x
IPad touch screen easier to use		x		x	x	x	x	x
Paying attention	x	x		x		x	x	
Interactive	x	x	x	x	x	x	x	
Ability to highlight	x		x	x	x	x	x	
Ability to underline			x	x	x	x	x	
Ability to Circle	x		x	x		x		
Access learning materials	x	x	x	x	x	x	x	
Instantly feedback from apps	x			x	x	x		
					x	x		
Peer feedback	x		x	x	x	x		x
Taking quizzes	x		x			x	x	
Teacher feedback	x							
Collaboration	x	x		x				
Individual student work	x		x				x	
One-on-one assistance	x	x	x	x	x	x	x	
Getting teacher help	x	x	x			x		
Students messing with settings		x	x		x	x	x	x
Sometimes the internet does not work	x	x	x	x	x	x	x	x
Sometimes the iPad battery is dead	x	x	x	x	x	x	x	
Should be updated frequently	x		x	x	x		x	

I clustered students' responses that carried the same meaning to identify emerging codes (table 9). The in vivo codes that emerged from student interview responses were related to the concept of technology integration and directly answered research question two on student experiences with the use of iPad apps in a Common Core standards-based math class. Clustering in vivo codes allowed me to easily identify codes that carried the same meaning or responses that were repeated by different students in different ways to create categories. Using Charmaz's (2008) recommendation of a comparative approach of creating categories, I highlighted codes that carried the same meaning in describing students' experiences and technology integration, using the same color and assigned them to a category as illustrated on table 10 below.

Table 10

Categories Created From Emerging Codes From Student Responses

Emerging Codes	Ariana	Bianca	Cathy	Daneshia	Enrique	Francisco	Harry	German
Student engagement	x	x	x	x	x	x	x	x
Assistive technology	x	x	x	x	x	x	x	
Assessment tool	x			x	x	x	x	x
Teacher support	x	x	x	x	x	x	x	
Differentiation in use of apps	x	x	x	x	x	x	x	
Challenges	x	x	x	x	x	x	x	x

Using the in vivo codes in table 10, I created categories by grouping the in vivo codes that carried the same meaning into a category (Table 10). The categories that emerged from clustering the in vivo codes were, student engagement, assistive technology, assessment tool, teacher support, and challenges. All students experienced engagement during iPad-use in math learning. Special Education students shared that use of iPad apps made learning fun, the touch screen was easier to use than traditional means of writing, and that staying on task made it easier for them to complete assignments. The majority of students' interview responses described their experiences with iPads as the ability to access the curriculum and ability to manipulate learning material by interacting with the text through highlighting, circling, underlining, and using the touch screen to write responses to math problems. This described technology integration as assistive technology in the form of iPad apps. The majority of students shared their engaging experiences with the types of apps used for the Common Core standards-based math curriculum to include Nearpod, IXL, and Kahoot. Out of all participating students, 6 experienced the iPad an assessment tool. Most students experienced individual teacher support while only 3 students experienced peer collaboration. However, all students experienced some form of challenges with iPad-use in the Common Core math classes.

Lesson Observation Content Analysis

To analyze data collected through lesson observations, I analyzed the contents of the observation instrument (Appendix C) and used line by line analysis of the field notes. The field notes were on how iPads were used, teacher to teacher interactions, teacher and student interactions, and student interactions. I color coded the observation instrument

sections. Next, I read through the field notes and highlighted lines that related to the color codes of the observation instrument. The following is a descriptive analysis of the data collected through lesson observations.

The two participating 8th grade math classes used the same classroom. The classroom had an academic vocabulary wall that supported learning in this unit of study. Some of the academic vocabulary posted on the wall included scatter graphs, trend line, bivariate data, association, linear association, negative association, positive association, cluster, and outlier. I also observed that there was a cart that contained iPads, another cart contained Chromebooks, and there was a shelf with scientific calculators. There was also an interactive whiteboard and a projector. My first impression of the classroom was that it was technologically equipped and that teachers not only used technologies such as iPad apps, but they also used supplementary materials such as vocabulary walls, wall posters, and complementary technology such as the interactive whiteboard and the teacher Chromebook.

During lesson observations, I focused on teacher and student activities to capture their experiences with using iPads. I used the observation protocol (Appendix C) for the observations and also wrote field notes on my observations. The unit of analysis was scatter graphs in which students solved word problems and analyzed given scatter graphs to describe trends in data and to write the equation of the line. The Common Core 8th grade math standard for the three lessons observed was, interpreting scatter graphs and investigating patterns of association between two quantities. The lesson plans for the

second and the third lesson observations had the same lesson plans. Lesson three was a continuation of lesson two. This did not provided latitude to code the lesson plans.

First lesson observations. The first lesson observation for classroom one was during the first week of the study. I recorded teacher activities and student activities using the observation protocol. I wrote fields notes and add to the lesson observation. I also took screen shots of student work on individual iPads for work samples during each lesson observation. The participating students had been identified on a sitting chart provided by the Mr. Williams.

Class 1 lesson observation. The observed lesson was based on a unit plan on statistics and data analysis. Daneshia, Francisco, and Harry were observed in class one from the beginning to the end of the lesson. Bianca came in during the last 30 minutes of class time. This did not affect the outcome of the results because I had three other students to observe. As students walked in, the teacher was playing soft music. At the same time, there was a scatter graph displayed on the interactive whiteboard. The directions for students were to write one sentence about the graph. As soon as all students were seated, the music stopped. Students quickly took out writing materials and started working on the warm-up problem displayed on the screen. This was a paper and pencil activity, with the use of the interactive whiteboard. On the top right corner of the whiteboard, there was a timer set for 5 minutes. As the lesson developed, Mr. Peters played music on his iPad and students obtained their iPads and rushed to be seated before the music stopped playing. Students were directed to use the Nearpod app. Student activity was to analyze and interpret given scatter graph by describing the relationship

between given variables. Finally, students were to write the equation of the line and explain the meaning of the equation.

While students were working on the problems using the Nearpod app, Mr. Peters and Mr. Williams walked around the classroom interacting with students and giving them feedback on their work. Daneshia sought help from Mr. Williams, the special education teacher. Mr. Williams referred to the posters on the vocabulary wall. Daneshia started to constantly use the posters as learning aides. Later, Mr. Peters projected students' work on the whiteboard and students gave each other feedback. Mr. Peters occasionally asked probing questions to facilitate student discussions.

Mr. Peters used the iPad for classroom management purposes at the beginning of the lesson. Music playing from Mr. Peters iPad was a means of classroom management because students responded to music playing by getting iPads and rushing to be in their seats before the music stopped playing. The regular education teacher, Mr. Peters played a leading role in instruction because he gave the directions on student activity, and determined the time for iPad-use. He also facilitated student discussions. Mr. Williams played the supporting role because he gave one-on-one support during iPad-use. There was also evidence of use of other learning supports including wall posters and vocabulary walls.

Class 2 lesson observation. Class two had a math class after lunch on the fourth block of the school schedule. The class used the same classroom as class one and the co-teachers were again Mr. Peters and Mr. Williams. This class had the same lesson plan as class one. The only difference was in the number of math problems to solve. Class two

had three fewer problems than class one. The same procedure of entering the classroom like that of class one, was used for class two. At the beginning of class, Mr. Peters was playing some soft music on his iPad. Students walked in from lunch with some noise, loud talking, and laughing. Mr. Peters increased the volume of music and verbally redirected the students to follow the "entering the classroom" procedure. Students quietened down and pulled out their papers and pencils to work on the starter problem that was projected on the whiteboard. The starter problem was for students to write a sentence about the scatter graph that was projected on the whiteboard. After the starter problem was discussed and graded by Mr. Williams who walked around grading while Mr. Peters was reviewing the problem with the whole class, the lesson transitioned to iPad-use. One student from each table distributed the iPads while Mr. Peters played a fast-paced music.

I could not observe Enrique on that day because he was absent from school. Cathy and Ariana were on task. Cathy was able to access the assigned problems on Nearpod and completed the assignment within the allocated five minutes. German had his eyes glued on the iPad screen without showing signs of doing any work. Occasionally, he raised his head to interact with peers in a playful manner. German exhibited signs of restlessness. At one point, he tried to snatch an iPad from a peer. When the special education teacher verbally redirected him to keep working on his iPad, German stated that his iPad battery was dead. The teacher directed him to get another iPad. During the last ten minutes of the lesson, students' individual iPad screens were projected on the interactive whiteboard. Students participating in the study were involved in the analysis of peers' answers.

Ariana came in during the last 30 minutes of class because she said that she was finishing testing with the school Psychologist. I was able to observe her working with a peer on writing equations from scatter graph and trend lines. Besides German's off-task behavior at the beginning of the lesson, when using iPads there was a lot of engagement by inclusion students that participated in the study. Both teachers also supported students when they walked around the classroom.

Second lesson observations. I did the second observations in each of the participating classes during the second week of the study. The lesson plan for class one that Mr. Peters provided was the same as for class two. The objective of the lesson was for students to draw scatter graphs using data given in word problems, analyze and interpret the data, and write the equations of the trend line.

***Class 1 lesson observation*.** The procedures for entering the classroom were slightly different form the ones observed in observation one. Soft music was playing and iPads were already on students' desk. A starter word problem was projected on the interactive whiteboard. The instructions were for students to pull out the data presented in the word problem. Students were instructed to use the ShowMe app for that activity. Bianca sought help from other students in the class. Daneshia covered her iPad screen with a book when Mr. Williams went over to look at her screen but was able to complete the work independently. Francisco depended on his peers to get help with drawing the trend line. Even though Francisco stayed on task, he struggled with writing the equation of the line because he could not determine the slope of the line and sought help from other students. At first Harry struggled with turning the iPad on. Mr. Williams gave

Harry another iPad and helped him to turn it on and to begin using the Nearpod app. When he got another iPad, Harry first highlighted the entire word problem including the questions until the special education teacher provided support. After getting that initial help, Harry was able to complete the assigned task without help from other students nor from Mr. Williams and Mr. Peters.

After five minutes of individual student work, Mr. Peters asked for volunteer students to share their work. Mr. Peters and Mr. Williams were also using their iPads. Bianca was among students who volunteered to show their work on the screen. When sharing work using ShowMe, Bianca volunteered her work for peer feedback and her iPad screen was projected on the whiteboard. Bianca had managed to pull out the data from the word problem after Mr. Williams read the word problem aloud for her.

The lesson progressed to students working with partners to read aloud the word problems and follow the wall poster for steps to solving word problems. The steps on the poster were listed as follows:

1. What is the problems asking?
2. What important information is given to help me answer the question?
3. What operations can help me solve the problem?
4. Does my answer make sense?

Bianca, Daneshia, Francisco, and Harry collaborated with peers in identifying the important given data in the word problems. Then students were instructed to use Nearpod to use the individual iPads to tabulate the data, draw scatter graph, and draw the trend line. Finally, students were given instructions to write the equation for the trend line and

explain the meaning of the equation. With consent from participating students, I took pictures of their iPad screens to get work samples. All participating special education students used the highlighting function on the uploaded PDF document with word problems to highlight all given data in the word problems.

Class 2 lesson observation. I carried lesson observation for class two in week two of the study. The lesson plan was exactly the same as for class one. The starter problem was a word problem on the Nearpod app. Students collaborated by reading together in partners and following the poster steps to solving word problems. Students also collaborated in identifying important data given in the word problem. Then, students were instructed to individually tabulate the data, draw a scatter graphs, draw a trend line for each graph, and write the equation for each trend line. During collaboration in reading, German was off task.

German was fidgeting and turning around to try to talk to peers. The general education teacher Mr. Peters, called out German by name and gave him two-step directions. Mr. Peters said, “German, first turn on your iPad”. German responded by looking at the teacher when his name was called out. Then he followed the short directive to turn on the iPad. Mr. Peters immediately addressed German saying, “Thank you for turning your iPad on German”. German nodded his head and smiled. Mr. Peters immediately said, “Next, tap on the Nearpod app”. German responded by clapping his hands when the app turned on. The special education teacher, Mr. William, called German by name and said, “Good job for turning your app on.” German continued to work and stayed on task.

Cathy worked with another student. She stayed on task and completed the assignment before the given time elapsed. However, she left class after 40 minutes of instruction with a restroom pass and did not return. Ariana sought help from Mr. Williams regarding which set of data were the x-values and which set were the y-values. Enrique worked with two other students and was seeking feedback on whether he had pulled out all the necessary data. All participating students in Class Two used the highlighting functions on Nearpod to highlight all important data in the word problems.

Third lesson observations. I did lesson three observations for each class on the third week of the study. Mr. Peters provided the same lesson plan for class one and for class two. After each lesson observation, I collected teacher lesson plans and student work samples. Teacher lesson plan indicated the Common Core Standard that guided the lesson, the lesson objectives, the technology to be used, and essential questions that guided the lesson activities. Both teacher and student activities were a continuation of the activities in lesson observation two. However, the word problems were different and students were using given word problems to construct scatter graphs, compare data sets, and interpret the scatter graphs. To check for understanding, students were assessed by identifying the scatter graphs that matched the given data sets and were supposed to identify the variables on the x and y-axis. The activity was iPad-based and student responses were projected on the interactive whiteboard.

During both lesson observations, I noticed that the teachers not only used the iPad to facilitate student learning by projecting their own screen on the whiteboard to give students clues on solving the problems, but they also referred to posted material on the

wall that supported student learning. For example, they used the poster on steps to solving word problems. The steps were listed as:

1. What is the problems asking?
2. What important information is given to help me answer the question?
3. What operations can help me solve the problem?
4. Does my answer make sense?

At the bottom of these steps, tips on solving word problems were listed as:

1. Highlight key words and phrases
2. Underline the question
3. Circle vocabulary terms
4. Annotate the key words, phrases, and the question

In both classes, students frequently looked at these posters while working on the problems on the Nearpod app. The posters seemed to support learning as well.

Class 1 lesson observation. Students entered the classroom following the same procedure as observed in lesson one and lesson two. Mr. Peters played music and students took iPads form the iPad cart. Using the ShowMe app, students worked on the starter problem which was exactly the same as the starter for the lesson in observation two. Students worked on the word problem projected on the whiteboard. The assignment was to pull out data presented in the word problem. Harry asked for help and worked with Mr. Williams. After fidgeting and turning her iPad upside down, Daneshia put her head down and Mr. Peters went over to help her work on the starter problem. Bianca sought help from another student when she was stranded on what data to pull out from

the word problem. After five minutes of individual work, students shared their findings. Volunteers were asked to have their iPad screens projected on the whiteboard for other students to give feedback. Francisco was one of the students who volunteered to have his work critiqued by others. Francisco was able to pull out the data presented in the word problem and even went ahead to categorize the data as independent (x-values), and dependent (y-values).

The lesson transitioned to collaborative learning. The lesson objective was for students to use given word problems to draw scatter graphs, the trend line, and write and explain the equation. Students worked with partners using Nearpod. With their partners, students read the word problems highlighted the essential information given in the word problems. Like in lesson observation two, students used the poster on steps to solving word problems. After, plotting the data on the scatter graph, students drew the trend line and wrote the equation. Finally, students were asked to explain the equations. Daneshia could not write the equations but was able to draw the scatter graph with the help of her partner. Harry worked with Bianca and both were able to complete the assignments. Francisco worked with another student and was able to complete the assignment. While working with another student, Francisco received a lot of support from his partner in reading the word problems.

Class 2 lesson observation. Like in class one, the lesson objective was for students to use given word problems to draw scatter graph, the trend line, and write and explain the equation. class two had the same class activities as class one. Students used ShowMe to work on the starter problems. Then, students used Nearpod to work on given

word problems. Students worked collaboratively with partners to read the problems and highlight given data, then draw the scatter graphs, the trend line, and write the equation. German, asked for a bathroom pass during the first five minutes of class. Mr. Williams talked to him privately and worked with him on the starter problem. Cathy worked well with her partner and completed the assignment. Enrique received a lot of support from his reading partner and from Mr. Williams in reading the word problems. He was able to highlight the given data, and with his partner completed all assigned activities. Ariana worked well with her partner and completed the assignment.

When the collaboration activity was completed, Mr. Peters used his Chromebook and projector to project student work on the whiteboard. The instruction was for students to critique each other's' work. Ariana gave a couple of positive feedback on projected work. She was able to compare two students' work whose trend lines were different. Ariana was able to identify the errors on the students' work. After a few minutes of students giving feedback to one another, Cathy exclaimed, "Now I know where we went wrong!". Mr. Peters pulled up Cathy's graph and allowed Cathy to do error analysis of her own work.

In the last twenty minutes of class, students took a three-word problem quiz. While taking the quiz, I observed how Cathy, German, Ariana, and Enrique used their iPads. All of them were highlighting on word problems on the Nearpod app. German was struggling with reading the word problems. He was mouthing the words and trying to read out loud. Eventually, Mr. Williams read the problems for him. Cathy, Ariana, and

Enrique stayed focused and did not ask for any teacher's help. Cathy left four minutes before the end of the lesson with a pass to the school office.

The codes I created through content analysis of the lesson observation instrument (Appendix C) and my field notes were. "use of apps like ShowMe, and Nearpod", "teacher choice of apps", "use of the Chromebook, projector, and interactive whiteboard", "individual student support", "student-to-student interaction", "classroom management", "highlighting", and "checking for understanding".

Lesson Plans Content Analysis

The teacher lesson plans had the first section identifying the Common Core Standard, learning objectives, the English Language development objective, and the positive behavior support objective. The next section of the lesson plan was entitled "engagement or technology-use". In this section, Mr. Peters identified technology, including apps, that were going to be used in each of the three lessons. In all the three lesson plans, the iPad, Nearpod, and interactive whiteboard were listed in the "Engagement" section. In lesson one, the ShowMe app was recorded for use for the starter problems in both classes. The student interaction activities listed were "student collaboration", "partner feedback", and "whole group feedback". The daily lesson plans were the same for the two classes except variations in the number of problems that students were assigned to do in each class. Class two was assigned fewer problems than class one. In the assessment section of the lesson plan, Mr. Peters listed starter problems, whiteboard projections, and feedback for lessons one and two. For lesson three, Nearpod Quiz was listed.

To analyze data on the teacher lesson plans, I used the content analysis strategy and highlighted similar phrases, or words that identified teacher and student activities and how iPads were used. This allowed me to use these for the coding process. I created the following codes using the interpretive approach of the outstanding words and phrases that addressed the concept of technology integration in an inclusion Common Core math class in each of the three lesson plans. Table 11 is a summary of the codes created from the three lesson plans.

Table 11

Codes From the Three Lesson Plans

Lesson plan codes	Lesson plan 1	Lesson plan 2	Lesson plan 3
Students writing the equation of the line		x	x
Students explaining the equation of the line	x	x	x
Students using data from word problems to draw scatter graphs	x	x	x
Students creating equations from scatter graphs	x	x	x
Nearpod		x	x
ShowMe	x	x	x
Wall Poster	x	x	x
Interactive whiteboard	x	x	x
Student collaboration		x	x
Student individual work	x	x	x
Using interactive whiteboard for feedback	x	x	x
Statistics and Data analysis	x	x	x
Interpreting scatter graphs and investigating patterns of association between two quantities	x	x	x
Using data from word problems to draw scatter graphs	x	x	x
Music playing for collection of technology	x	x	x

All three lesson plans had a section that identified the Common Core standard that guided the lesson. Each lesson plan had a lesson objective and the type of app to be used during the lesson was stated under the technology section of the lesson plan. Nearpod, ShowMe, Kahoot, and interactive whiteboard emerged as Assistive Technology that helped students access the curriculum, and manipulate the accessed learning material, through highlighting, underlining, and circling important information to demonstrate ability to process given information. All three lesson plans had sections that indicated how students were going to work on iPads. In 2 of the 3 lesson plans students were using iPads to work collaboratively and independently to access learning materials and complete class learning activities. The lesson plans also indicated that Mr. Peters used iPads to play music to manage the time of distributing iPads.

Using Charmaz's (2008) recommendation of cluster grouping, I grouped similar codes or repetitive codes into categories that described the meaning of the cluster codes. Table 12 is a summary of the categories created from the lesson plan codes

Table 12

Categories Created From Lesson Plan Codes

Assistive technology	Nearpod ShowMe app Interactive whiteboard
Students interacting with learning materials	Collaboration Individual student work Peer feedback Explaining the equation Using data from word problems to draw scatter plots Creating equations from scatter graphs
Immediate feedback	Using interactive whiteboard for feedback
Classroom management	Music playing for technology distribution

Clustering codes that carried the same meaning resulted in emerging codes that addressed the concept of technology integration. Teachers experienced use of iPad-apps as assistive technology for students with math learning disabilities. Apps like Nearpod, ShowMe, and IXL enabled students to interact with learning material, and to get instant feedback from the app, peers, and teachers. Teachers also use the iPad for classroom management. Music playing on the iPad paced students as they collected, distributed, and put away the iPads.

Student Work Samples Content Analysis

I used content analysis to analyze student work samples. The student work samples from both classes were pictures of students' iPad screens that captured how students used the iPads. Some student work showed highlighting of phrases, underlining of questions, and circling of vocabulary terms and facts in word problems given. Among the students participating the study, 6 used the highlighting feature. All participating special education students' work samples showed that students used the touch screen to draw the scatter graphs, the trend lines, write the equation, and explain the graph. Student work samples also showed that 8 students pulled out the data from word problems, tabulated the data, and drew the scatter graphs. Table 13 below summarizes categories created from analyzing student work samples.

Table 13

Summary of Categories From Student Work Samples

Categories	Number of students
Highlighting	6
Use of the touch screen	8
Pulling out data to tabulate/completing assignments	8

The categories that emerged from student work samples were highlighting, use of the touch screen, and pulling out data to tabulate. These categories addressed technology integration and affirmed Kolb's (2013) assertion that learning is a continuum that describes how students process the information. Highlighting, underlining, tabulating data, and circling, directly answered research question two on the experiences of students with using iPads. In Level II of analyzing data, I compare the categories from lesson observations, student interviews, and student work samples to identify emerging themes that helped to answer research question two.

Level 2 Data Analysis

In the second cycle of data analysis (Level II), I compared categories from the teacher interview data sources, lesson observations, and teacher lesson plans to create themes. I used the thematic analysis approach (Braun, Clarke, Hayfield, & Terry, 2019) to analyze and combine categories into themes that described the meaning of the combined categories. The emerging themes helped to answer research question one as described in the results section. I followed the same procedure with student interviews,

lesson observations, and student work samples to create themes from codes and categories created using student data sources. I used the emerging themes to describe the results.

I used thematic analysis by identifying and interpreting patterns of categories and codes in various data sources for each research question. As a new researcher, thematic analysis allowed me to use a simplified way of systematically analyzing categories created in level 1 on data analysis, interpreting it and identifying it as broader concepts or themes (Braun et al., 2019). There are six phases of thematic analysis. I did Phase one and two when I created codes and categories. Level two of data analysis begins at phase three of the thematic analysis approach. Braun et al. (2019) identified phase three as a stage for searching for themes. The process involves collapsing and clustering categories that share the same meaning. Phase four is a recursive process of reviewing developing themes. Phase five is defining and naming of the themes. In this phase, I clearly stated what is unique about each theme as they directly answer the research question. Phase six is the reporting of the findings,

In the second cycle of data analysis, I grouped categories that carried the same meaning from different teacher data sources to create themes that addressed teacher experiences. I followed the same procedure for student data sources to create themes that addressed student experiences. In the results section, I used the emerging themes to describe answers to research question one and two separately.

Themes From Teacher Data Sources

To create themes using teacher data sources, I used the categories from teacher interviews, observation lessons, and teacher lesson plans. I compared the categories and grouped them into themes that defined the meaning of each cluster of categories. Four major themes and seven minor themes emerged. The major themes included student engagement, iPads used as assistive technology, iPads used as assessment tools, and use of iPads posing challenges to teachers. I describe these themes in detail in the Study Results section to answer research question one.

Themes from Student Data Sources

To create themes from student data sources, I grouped categories that carried the same meaning and identified emerging themes. Six major themes emerged. These themes were, the iPad used as assistive technology, students interacting with Common Core learning material, students receiving individual academic support, engagement in learning activities, the iPad used as an assessment tool, and the challenges faced by students during use of iPads. In the study findings section, I described these themes in detail to answer research question two.

Evidence of Trustworthiness

Results of a research study must be reported in a trustworthy manner (Maxwell, 213). To achieve trustworthiness, I paid attention to the methods of data collection, analysis, and interpretation. I achieved trustworthiness by the methodology of the study through the data collection processes, and data analysis and interpretation.

Credibility

To achieve credibility in this study, I used triangulation by collecting data from multiple sources. Collecting data from different sources allowed for comparisons of the findings. This helped to build credibility and dependability of the data findings. Yin (2014) stated that case study findings are more convincing if based on multi data sources. The different strengths and limitations of different methods of data collection (Maxwell, 2013) supported the conclusions made about the experiences of inclusion teachers and special education students using iPad apps in math classes. Triangulation as a way of dealing with validity of threats reduced the risks of basing research conclusions on one specific method (Maxwell, 2013). An in-depth collection of data using multiple sources including lesson observations and field notes, audiotaping, teacher and student individual interviews, lesson plans, and student work samples gave conclusions more credibility and provided corroborating evidence (Yin, 2014). After the transcription of audio-tapes, I used member checking to establish credibility. I gave teacher and student participants the transcriptions and findings for validity and clarification of findings. Finally, I took the results and conclusions to the participants of the study for credibility (Yin, 2009).

Transferability

Transferability refers to external validity or to how much research findings can be generalized to other settings. For transferability, I included students of different demographic characteristics to participate in the study. Variation in demographic characteristics allowed for any discrepant cases arising to be explored and described to deepen the understanding of the participants' experiences with using iPad apps.

Dependability

Dependability refers to reliability. To establish reliability, I used the observation instrument to record observations. I also used an iPhone to audio-tape record the interviews to produce good recording and to capture everything in the interviewee stories about their experiences with using iPads. I transcribed the tape. Using codes and categorizing information from different transcripts into codes I collapsed the codes into major themes.

Confirmability

For objectivity, I carried out the data collection process at another school site other than my own to overcome possible vested interests in the research. I kept a research journal to make notes on my feelings during each observation (Appendix C).

Results

Research Question 1: Teachers' Experiences

Research question one was, what were the experiences of 8th grade inclusion teachers with using iPads for the Common Core math standards? The focus of the question was on the experiences of the regular education and the special education teachers with iPad-use in an inclusion class with students with MLD. From the analysis of teacher interviews, lesson observations, and lesson plans five major themes directly answering the research question emerged. The major themes were, experiencing special education student-engagement, the iPad as assistive technology, using the iPad as an assessment tool, choosing apps during the planning process, and challenges of using the iPad. Minor themes included teachers experiencing increased special education students'

academic performance when using iPads, students increasing confidence when solving math problems. A breakdown of the findings for research question one appears in the table below.

Table14

Themes Emerging From Teacher Data Sources

Themes	Number of participants
Major Theme 1. Student engagement	2
Minor Theme 1. Improved student performance on assignments	1
Minor Theme 2. Improved student confidence in doing math problems	1
Major Theme 2. IPads as assistive technology	2
Minor Theme 1. IPads enabling students access to the curriculum	1
Minor Theme 2. IPad-use providing rigorous learning materials	1
Major Theme 3. IPad as an assessment tool	2
Minor Theme 1. IPads used to progress monitor students' performance in math goals	1
Minor Theme 2. Flexibility in choice of apps for assessment	1
Major Theme 4. Challenges with using iPads	2

Major Theme 1: Teachers experiencing student engagement. One of the major themes of the study was, teachers experiencing student engagement during iPad-use. Both teachers said they experienced student engagement in lessons where teachers and students used iPad apps. Both teachers described student engagement as students working on assigned tasks during lessons. Mr. Peters stated that students were more willing to work when using iPads than when he gave them paper and pencil work and added that

students participated more in learning activities when using iPads. Mr. Peters elaborated on engagement as students being calm, focused, staying on task, and participating in learning activities. Mr. Williams shared that one of the characteristic behavior tendencies of special education students in their inclusion classes was that of being off task and having disruptive behaviors if they are not using iPads. He elaborated, "when I see them sitting down and focusing on their work, staying on task and completing assignments when using any of the technologies, they are engaged". Mr. Williams also emphasized that students were eager to volunteer sharing their work through projection on the whiteboard for peer feedback.

The content analysis of direct lesson observation notes and lesson plans yielded results that corroborate the theme of teachers experiencing student engagement. During all three lesson observations for each of the 8th grade classes, Mr. Peters played music from his iPad and students responded to the music by collecting learning materials including iPads. Student engagement was one of the categories that emerged from all three lesson plans provided. All three lesson plans had a section titled "Student Engagement/ Technology".

Minor Theme 1: Teachers experiencing improved student performance on assignments. While both teachers elaborated on student engagement as students participating in learning activities and staying on task, only one teacher emphasized that use of iPad apps improved special education students' performance on math assignments. When asked to elaborate on student engagement, Mr. Williams' response was,

> When students use iPad-apps they tend to do better on assignments than when they are using worksheets. It is interesting that sometimes we upload the same worksheet as PDF on Nearpod and student scores tend to be better than when they solved the same problems as paper and pencil activity.

Student work samples showed that all participating special education students completed the assignment of pulling out data from given word problems to tabulate given facts. During lesson observations, I witnessed all participating special education students completing given assignments.

Minor Theme 2: Teachers experiencing increased student confidence to solve math problems. Even though both teachers shared that student-participation in learning activities increased with the use of iPad apps, one teacher stated that special education students' confidence in solving math problems increased. While elaborating on student engagement, Mr. Williams shared that students volunteered their work to be displayed on the whiteboard for feedback from peers and added that use of technology boosted student confidence in solving math problems.

During lesson observations, I witnessed participating special education students volunteering their work to be projected on the screen for feedback from peers.

Major Theme 2: Teachers using the iPad as assistive technology. Both teachers' descriptions of what they experienced during use of iPads allude to the definition of assistive technology. In Chapter 2, I defined assistive technology as any technological product that enhances learning for students with disabilities. In the preliminary interview, Mr. Peters described the iPad as having a touch screen and

interactive. Such iPad characteristics are ideal for kinesthetic learners. Mr. Peters stated that when using the iPad apps like Nearpod, students have access to uploaded learning materials, can watch videos and do projects, and that the learning activities bring abstract concepts to real life experiences through real life problems, graphs, diagrams and pictures. In the preliminary interview, Mr. Williams emphasized that the iPad was a necessary tool that gave students visuals and helped in meeting students' learning needs. In the follow-up interview, Mr. Williams stated that use of apps enabled student-access to the curriculum. Mr. Peters indicated in the lesson plan section of technology integration what technologies were used to engage students in learning activities.

Minor Theme 1: IPads enabling students to access the curriculum. One teacher described iPads as technology that improves special education students' learning experiences through visuals that enhance accessing the curriculum. Mr. Williams stated, "in the accommodations section of most students' IEPs, teachers should use visuals to improve students' learning experiences". During lesson observations, students looked at the pictures that illustrated the word problems that they were solving. Therefore, iPads were used as a tool to meet special education students' learning accommodation needs to enable them to access the curriculum.

Minor Theme 2: IPad-use providing rigor required by the Common Core standards. One teacher shared that iPads provided rigorous activities to all students required by the Common Core math standards. Mr. Peters stated that the Common Core standards demand a rigorous approach to instruction and learning and that it was difficult for him to create rigorous activities. Therefore, Nearpod became useful because the app

had several rigorous math lesson activities. However, Mr. Peters also mentioned that he sometimes supplemented some of the Nearpod activities with his own rigorous activities. Therefore, in this study technology integration not only addressed the learning accommodation needs of students, but also provided access to rigorous academic activities required by the California Common Core Mathematics Standards.

Major Theme 3: Teachers using the iPad as a tool for assessments. In lesson plan two, Mr. Peters indicated, in the assessment section, that students were going to use Kahoot for checking for understanding. In lesson three, Mr. Peters indicated that students were going to take a quiz on Nearpod. In lesson three observation, I witnessed students using the Nearpod app to take a quiz. Both teachers stated in their preliminary and follow-up interviews that using the iPad gave them the ability to quickly assess student mastery of concepts learned. Mr. Williams mentioned that when students use the iPads to take quizzes on Kahoot and Nearpod, it allowed teachers to assess whether special education students were making progress towards meeting their math IEP goals. He further stated that this gave teachers opportunities to evaluate the effectiveness of teaching strategies and to design interventions for students challenged by math learning.

Minor Theme 1: Monitoring special education students' progress towards meeting in math IEP goals. Of the two participating teachers, Mr. Williams expressed his appreciation of using iPads as an assessment tool in relation with IEP math goals and he stated that use of iPads allowed easy monitoring of special education students' progress toward meeting their IEP math goals. He further elaborated that special education students' math IEP math goals were aligned with the 8th grade Common Core

math goals and that continual checking for understanding using iPads allowed him to have a quick assessment of progress towards meeting the IEP goals. When asked how iPads were used in an 8th grade inclusion math class, Mr. Williams responded,

> When student work is projected on the screen, it gives me a quick overview of how special education students are doing in terms of understanding the concepts and working towards meeting their IEP math goals that are based on the Common Core standards.

He added that use of apps like Kahoot and Nearpod also gave instant feedback on the performance of special education students allowing him to document progress towards meeting IEP goals. Therefore, use of iPad apps in a Common Core 8th grade inclusion math class was not only for instruction and academic assessment, but was also a means of monitoring student progress in meeting special education academic goals.

Minor Theme 2: Flexibility in choice of apps for assessment. Both teachers mentioned use of Kahoot and Nearpod as apps used for assessing students. Mr. Peters emphasized that he had to be deliberate in choosing apps for assessing student learning such as Kahoot and ShowMe for quick assessments, and Nearpod for longer assessments. Therefore, use of the iPad gave teachers access to various math apps for assessments.

Major Theme 4: Challenges faced by teachers. Another theme that emerged was that teachers encountered challenges with use of iPads for instruction and learning. Both teachers reported that it was time consuming to keep the iPad apps updated because they had to update each iPad at a time. Both teachers also expressed concern about

students leaving iPads uncharged because it affected the availability of technology for use the next day.

Mr. Peters shared that he did not know how to use the text-to-speech function of the iPad. When asked to elaborate on how he used the iPad with the special education students, Mr. Peters said, "I know that they have accommodations such as text-to-speech, but I do not know whether the iPad is capable of doing that". Also, Mr. Williams mentioned that sometimes special education students feel better writing things manually instead of using the touch screen. This implied that even though teachers had experience with using iPads in a math class ranging from 4 to 8 years, they still had some challenges with capabilities of the iPad, including providing comfortable writing experiences for students, and using text-to-speech.

Research Question 2: Students' Experiences

Research question two sought to investigate the experiences of 8th grade special education students with using iPad apps for learning Common Core math standards. The emergent six major themes included, students using iPads as assistive technology, interacting with learning materials, receiving academic support, engaging in learning activities, and facing challenges with using the iPad. The four minor themes included students understanding word problems, improved student learning experiences, iPad touch screen enabling easier interaction with learning material, and students staying on task. The table below summarizes the themes emerging from student data sources.

Table 15

Themes Emerging From Student Data Sources

Major theme	Number of participants
Major Theme 1. IPad as assistive technology	6
Minor Theme 1. IPad apps making word problems easier to understanding	4
Minor Theme 2. Choice of apps that improved student learning experiences	3
Major Theme 2. Student-interaction with learning material	6
Major Theme 3. Student Academic Support	6
Major Theme 4. Student engagement	6
Major Theme 5. Assessment Tool	6
Major Theme 6. Challenges of iPads working properly	6

Major Theme 1. Students using iPads as assistive technology. The first major theme of the second research question was that students experienced use of iPads as assistive technology. During individual interviews, six out of eight students identified apps used to access learning material as either ShowMe, Nearpod or Kahoot. German stated that teachers told students to use Nearpod because the app provided access learning activities that was already uploaded. Francisco mentioned that, on Nearpod graphs are sometimes already provided for the lesson and used the touch screen to identify the x and y intercepts. Enrique shared that use of the Nearpod app made math learning easier because the videos and pictures made it easy to understand math. Daneshia underscored

her ability to highlight and that improved her understanding of math concepts. Bianca highlighted the availability of learning activities on Nearpod while Cathy also mentioned that there were lessons already uploaded on Nearpod. Ariana also stressed that Nearpod allowed students to easily follow along an already uploaded lesson. This implied that use of iPad apps provided access to the curriculum and made Common-Core-standards-based learning material understandable to special education students.

Minor Theme1: IPad apps making word problems easier to understand. One minor theme was that use of iPad apps made learning material easier to understand for special education students. In answering the question on the advantages of using iPads for math learning, four out of eight students stated that it was easier to process word problems and to draw scatter graphs on Nearpod. Ariana, Bianca, Harry, and Cathy mentioned that math word problems were easier to learn when using apps because they were able to highlight, circle, and underline information that helped them answer the questions.

Minor Theme 2: IPad apps improving student learning experiences. The second minor theme was that students experienced using apps that teachers chose to improve student learning. Harry shared that he respected teachers' decisions on the choice of apps because the apps enabled him to better understand math word problems. In answering the questions on choice of apps, Enrique and German emphasized that teachers chose apps depending on the activities of the lesson and that teacher chosen apps were appropriate because they made learning fun and easier. Bianca stated that using iPad apps was easier and made learning fun compared to paper and pencil activities. Therefore, when math

apps are carefully chosen to meet student learning needs, they improve learning experiences of special education students.

Major Theme 2: Special education students interacting with learning materials. Another major theme for research question two was iPads providing opportunity for special education students to interact with learning materials. Six out of eight students mentioned the advantage of using the iPad apps as either the ability to use the touch screen, highlight, and underline important learning material. Cathy, Daneshia, Enrique, Francisco, German, and Harry emphasized that using the touch screen, highlighting, and underlining improved their learning experiences. Analysis of lesson observations showed that all participating special education students used the touch screen to pull out and tabulate data given in word problems. Student work samples provided evidence that students interacted with learning materials using the Nearpod app. All eight student work samples had student-made-tables with data pulled from given word problems.

One minor theme was that the iPad touch screen enabled special education students to interact with learning material. Out of eight students, four stated that the touch screen enabled them to interact with the learning material. However, all student work samples provided student writings as evidence of students using the touch screen.

Major Theme 3: Student receiving academic support. Students experienced support from either peers or from any of the two teachers. Eight out of eight students stated that they get feedback from peers when their work is projected on the screen. During lesson observations, special education students were observed collaborating with

peers and also giving each other feedback during class discussions of individual student-work projected on the interactive whiteboard. Out of the three lesson plans provided for content analysis, two lesson plans stated that student work would be projected on the whiteboard for peer-feedback.

Major Theme 4: Students engaged in learning activities during use of iPads for learning activities. Six students said that they were engaged in learning activities and completed assignments when they used of iPad apps in their math lessons. I also observed special education students who participated in the study being engaged in learning activities by collaborating with peers, seeking for teacher support, and giving peers feedback during whole group discussion of individual student-work projected on the whiteboard.

One minor finding was that students stayed on task when using iPads. Analysis of lesson observations showed in both classes five out of eight students stayed on task throughout the observation period. Analysis of individual student interviews also showed that four out of eight students intimated that they stayed on task when using iPad apps for math learning. Ariana stated, “We don’t get distracted”. Cathy mentioned that when students use iPads, they pay attention and stay on task. Daneshia shared that students did not get distracted like they did when using paper and pencil learning activities. Enrique also shared that he tended to stay on task when using iPad apps than when using worksheets.

Major Theme 5: Students using the iPad as an assessment tool. Students shared that they used various apps to take quizzes and tests. Six out of eight students said

that math apps gave them immediate feedback on their performance in the lesson objectives and the Common Core standards. Ariana mentioned that she likes the Nearpod app because she received immediate feedback. Daneshia shared that she liked getting feedback from peers when student-work was projected on the interactive whiteboard. Enrique, Francisco, and Harry stated that they took quizzes on Kahoot and test on Nearpod and received immediate feedback on the performance on the standard.

Major Theme 6: Challenges faced by students. All eight students shared that they get frustrated when the internet was slow and when they could not get on the internet at all. All eight students also shared that sometimes the iPads were not charged and could not be used the following day.

Discrepant Data

Marshall and Rossmann (2016) emphasized analyzing discrepant data for credibility and dependability. After creation of categories and themes emerged, there was data that did not fit into any of the categories. One of the student participants shared disadvantages of using iPad apps by comparing using the iPad to using the Chromebook. Harry said that he preferred using the Chrome book to using the iPad.

> When asked about the challenges of using iPad apps, Harry's response was,
>
> It is difficult to type on an iPad because there is no keyboard like on a Chromebook. I prefer using Chromebooks. IPads are difficult to use because of the frequent app updates. We should start using Chromebooks frequently. We will still be able to download apps on A Chromebook like we do on iPads.

Based on the difficulty of typing on an iPad, Harry found iPad-use challenging and preferred using the Chromebook apps. Further research on the experiences of users of math apps on any electronic device such as the Chromebook is needed.

Summary

Chapter 4 is a description of the findings based on the analysis of data collected from various data sources including teacher and student interviews, lesson plans, direct observations of lessons, and student work samples to answer the research questions. The purpose of the study was (a) to investigate the experiences of inclusion math teachers using iPad apps for the 8th grade Common Core standards with students with math learning disabilities; and (b) to investigate the experiences of inclusion special education students using iPad apps in an 8th grade inclusion math class that uses the Common Core math standards. For research question one, four major themes and several minor themes emerged. For research question two, six major themes and four minor themes emerged. Chapter 5 is a discussion of the findings, limitations, recommendations, and conclusions of the study.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of this study was to describe the experiences of eighth-grade inclusion teachers using iPads in the Common Core math curriculum, and to describe the experiences of eighth-grade inclusion special education students using iPads in the Common Core math curriculum. Dewey's (1938) experiential learning theory, the TPACK model of technology integration (Koehler et al., 2014) and the UDL model (Hitchcock, Meyer & Rose, 2002) were the theoretical lenses used to analyze participants' interview responses, lesson observation notes, content of lesson plans, and contents of student work samples to understand inclusion eighth-grade iPad users' experiences. Recently, the number of schools integrating the iPad as technology for learning and instruction in classrooms has increased. Although some teachers have integrated iPads into their math curriculum, some teachers have demonstrated reluctance in integrating innovative technology, such as iPads, for pedagogical purposes.

There is limited research on the experiences of both inclusion teachers and special education students with using iPad apps for pedagogical purposes. The purpose of this study was to describe the experiences of eighth-grade inclusion math teachers and special education students with using iPad apps in a Common Core math curriculum. The key findings of this study were that iPad math apps provided assistive technology for students, made word problems easier to understand, provided access to learning materials, increased students' learning engagement, improved on-task behaviors, and provided assessment tools.

The theoretical framework that guided this study was Dewey's (1938) experiential learning theory, the TPACK model (Koehler et al., 2014), and the UDL (Hitchcock, Meyer & Rose, 2002). The TPACK model and UDL share the same concept of technology integration for the purpose of making the curriculum accessible to students. Dewey's experiential learning theory focuses on learning as a result of experiences and describes the concept of experiential learning as a pedagogical strategy that focuses on students being active in their learning (Carr, 2012). Dewey explained experiential learning as a concept that influences teacher choice of student-centered pedagogical activities.

My key findings supported Dewey's concept of experiential learning involving students as active learners. The findings also indicated that teachers deliberately chose student-centered iPad apps that encouraged student engagement in exploring Common Core math learning activities. The deliberate choice of apps was consistent with the principles of UDL. UDL principles help educators improve student learning experiences. In implementing the principles of UDL, teachers should consider various means of student engagement and provide differentiated ways of demonstrating learning (Meyer, Rose, & Gordon, 2014). The TPACK model (Koehler et al., 2014) describes the three types of knowledge that teachers require for effective incorporation of technology into the curriculum. The TPACK model emphasizes the interrelatedness of teacher fluency in the content of the subject, pedagogical skills, and decisions in integration of technology (Olofson, Lewis, & Newmann, 2016). Findings in the current study supported this concept and indicated that math teachers were fluent in the content of the Common Core

math curriculum and had pedagogical strategies that supported special education students, and that lesson content and the accommodations that special education students needed to access the Common Core math curriculum influenced choice of iPad apps to integrate in the curriculum. The UDL is a lens through which an educator may design instruction to enable access to the curriculum and optimize learning for all students can be examined (Alnahdi, 2014). My findings corroborated the idea that teachers designed instruction and were deliberate in choosing technology such as iPad apps that provided access to learning Common Core standards-based math curriculum to students.

Interpretation of Findings

In the following subsections, I discuss the interpretations of the findings. I also discuss the findings that confirmed, disconfirmed, and extended the body of knowledge regarding experiences of iPad app users in a mathematics curriculum at the middle school level.

Teacher Experiences

The first research question addressed the experiences of high school inclusion teachers regarding using iPad apps for the Common Core math curriculum. There were four key findings for this research question and minor themes associated with the major findings. The four key findings were that teachers experienced increased student engagement, iPads were used as assistive technology, iPad apps were used as assessment tools, and teachers experienced challenges with using iPads for instruction and student learning.

The first key finding for Research Question 1 was that teachers experienced increased student engagement in math learning when integrating technology in the form of iPad apps in a Common Core math curriculum. Soffer and Yaron (2017) defined student engagement as effortful participation in learning activities and described it as playing an important role in improving students' learning experiences and outcomes. The finding that teachers experienced student engagement in math learning affirmed the assertion that mobile technologies, including iPads, increase student engagement and make learning enjoyable (see Epps, 2016; Murphy, 2016; Retalis et al., 2018). Zhang et al. (2015) asserted that apps improve student engagement in learning. Kaur et al. (2017) maintained that iPad apps increase student engagement because the iPad functions such as the touch screen, and other features such as text enlargement, highlighting, images, and sounds enable students to manipulate content and experience learning in a different way from traditional teaching methods. This finding also confirmed Salend and Whitaker's (2017) assertion that the UDL approach to instruction triggers student motivation and engagement in learning activities. This finding was also consistent with previous research on integrating technology in the form of apps for math instruction. The findings on student engagement also affirmed that students enjoy using iPads for learning (Maich et al., 2017).

Ciampa (2014) found that engaged students tended to be attentive in class, participated in learning activities, had increased interest in the content, and were motivated to learn. In investigating the effectiveness of app-based math instruction for students with learning disabilities, Bryant et. al (2015) reported increased student

engagement. Ok and Bryant (2016) stated that technology increased positive student learning behaviors such as observed student engagement and completion of assignments. Hilton's (2018) investigation of the impact of using iPads for teaching and learning on student engagement in mathematics indicated that student engagement increased and perceptions of math learning improved. However, other researchers emphasized the importance of teacher-facilitated iPad activities for student engagement with learning materials to be meaningful (Stacy, Cartwright, Arwood, Canfield, & Kloos, 2017). Student engagement and academic achievement in math are interrelated (Evans, 2015; Schuetz et al., 2018). Schuetz et al. (2018) found that there was a decrease in students' academic performance when they did not engage in a math game based on technology.

In the current study, Mr. Williams mentioned that part of his role as the inclusion special education teacher was to provide accommodations and necessary tools that supported students in understanding math concepts and kept them engaged in learning. These necessary tools were observed to be iPad apps. However, during direct observations, German was off task when he could not access the Nearpod app because his iPad was not working. Mr. Williams was observed redirecting the student and helping him by getting another iPad and helping him to log on and do the class activity. Teacher guidance and direct interaction with students during iPad use was necessary and important. This confirmed the TPACK principles of technology integration. The teacher must have technology knowledge, content knowledge, and pedagogical strategies to effectively use technology to improve student learning experiences (Olofson et al., 2016). Mr. Peters shared that he had to be deliberate in choosing the apps that helped with

providing accommodations for students. Although technology is helpful, students still need for a teacher's guidance and support when using iPads for learning.

The minor themes associated with student engagement were improved student performance and confidence in solving word problems. The finding that students' confidence in solving math problems increased affirmed Ok and Bryant's (2016) finding that technology integration improved student attitudes toward math learning. Students' use of iPad video recording increased their confidence in communicating and contributed to verbal dialogue during learning activities (Ockert, 2014). The finding also affirmed Hilton's (2018) assertion that iPad use in mathematics has the potential of improving students' attitudes toward mathematics. Calder and Campbell (2016) reported that the use of apps in mathematics improved students' attitudes toward mathematics and their enthusiasm for math learning. However, not all studies indicated that the use of iPads for learning boosted students' confidence in learning activities. Kontkanen et al. (2017) investigated students' experiences with iPads and found that students lacked confidence to change their styles of learning when using technology. Kaur et al. (2017) investigated the potential of using iPad apps to supplement math teaching and discovered that special education students became comfortable and improved their willingness to solve math problems. In the current study, I witnessed special education students confidently volunteering their work for projection on the screen for analysis by peers. The special education students also contributed to the classroom dialogue by giving justifications for their method of solving the problem.

The second key finding was that teachers used iPads as assistive technology for students with math learning disabilities. Erdem (2017) described assistive technology as tools that improve student learning experiences. Bicehouse and Faieta (2017) maintained that technology integration is crucial when using UDL principles to facilitate accessibility. Alnahdi (2014) defined the purpose of UDL and assistive technology as a means of overcoming barriers to make the general curriculum available to special education students. My finding confirmed Cumming et al.'s (2014) assertion that assistive technology is effective in supporting learning for students with learning needs, and affirmed Erbes, Lesky, and Myers's (2016) finding that teachers were hopeful that integrating mobile devices into the curriculum could improve student learning. This finding also corroborated Larkin's (2014) assertion that there are high quality apps that promote student learning.

Assistive technology in the form of math apps allowed access to adapted academic content to students with learning needs. Mr. Williams shared that iPad apps made content knowledge available to students. Mr. Peters stated that apps like the Nearpod had functions that allowed students with learning needs to manipulate learning material to suit their learning needs. Both teachers shared that students were able to highlight, underline, circle key words in word problems using the functions on the Nearpod app. This corroborated Al-Mashaqbeh's (2016) finding that iPads enabled of students to manipulate content hence appealing to the kinesthetic learner. Some special education students with learning disabilities are kinesthetic learners (Al-Mashaqbeh, 2016). Using iPad apps with many functions, such as those of the Nearpod, provides the

kinesthetic learning experiences for kinesthetic learners (Al-Mashaqbeh, 2016). During direct lesson observations, I witnessed special education students using the iPad touchscreen to manipulate content by highlighting, and writing annotations in the Nearpod app.

The minor findings were that iPads enabled teachers to provide access to the general curriculum, and enabled teachers access to rigorous instruction and learning materials for use in the Common Core math curriculum. These minor themes agree with the National Technology Plan (2016) that describes technology as a tool that is capable of changing pedagogical practices and powerful to accommodate students' learning needs. These findings also confirm Bicehouse & Faieta's (2017) assertion that technology integration is crucial in the implementation of UDL to facilitate accessibility.

The third major finding was that teachers experienced using iPad apps as assessment tools. In California, the Smarter Balanced Assessment Consortium (SBAC) uses technology to test students' progress in Common Core math standards. The computer-based assessment has accommodations that provide assistive technology to students with learning disabilities. These accommodations include speech-to-text, and calculators. In a study investigating student testing (Ling, 2016) the results included students favoring testing on an iPad or a computer. Therefore, using iPads as an assessment tool gave students experience of using technology for assessment and exposure to SBAC testing experiences.

The fourth major finding was that even though use of iPad apps had several benefits, teachers still faced several challenges. Some of the challenges related to

technological know-how. Technological know-how refers to the ability to use technology to influence content learning. One of the challenges that teachers experienced with using iPad apps was the lack of knowledge about using the text-to-speech function of the iPad. During lesson observations, Mr. Williams read the word problems to students. On the follow-up interviews, Mr. Peters shared he was not sure how they can implement the text-to-speech accommodations on student IEPs using the iPad. Technical know-how was interfering with efficiently using iPad functions. Other challenges that teachers encountered included slow internet, iPad battery lifespan, and the need to frequently update the iPads. Both teachers shared that updating the iPads and staying current with new apps that could be used in the math curriculum was time consuming. Both teachers also explained that sometimes the internet was very slow and that affected downloading speeds and subsequently pacing of lessons and amount of learning.

Student Experiences

The second research question investigated the experiences of special education inclusion students with using iPad apps in a Common Core inclusion math class. Six major themes and four minor themes emerged from the investigation. John Dewey's experiential learning theory (1938) zeros on students' experiences as the center of instruction and learning. Similarly, the universal design for learning model focuses on instruction design and how it helps educators the value of technology in providing access to learning. The TPACK model emphasizes the educator's knowledge on technology, content, pedagogical skills to influence students' learning experiences. This theoretical

framework and the concept of technology integration guided the interpretation of students' learning experiences with iPad-use in a Common Core math inclusion class.

Students were able to access Common Core learning materials by using iPad apps as assistive technology. One of the goals of inclusion was to make the curriculum accessible to special education students. Assistive technology provides students with the means to overcome learning barriers. In this study, the majority of students described their interaction with Common Core materials through the Nearpod app. Several students shared that they were able to understand word problems because they could process the problems through interacting with the text using the functions of the app such as highlighting, underlining, and circling of essential information in a word problems. Such interaction with the text, made it easier for students to process and understand word problems. The finding confirms the Kaur et al. (2017) findings that iPads for math learning increased understanding of various math concepts including numbers and order of operations. This finding also concurs with the assertion that assistive technology can increase student learning (Ahmed, 2018).

Students were not only able to access the Common Core standards-based learning materials through the Nearpod, but they were also able to interact with the learning material in a way that removed barriers to learning. The majority of students shared the benefit of the touch screen as including the ability to manipulate learning material using the accessibility options of the Nearpod app. These accessibility options included ability to write on the touch screen, highlight, circle, and underline important information in given word problems. This finding is in agreement with Nepo's (2017) assertion that

accessibility options on iPads provide flexibility to meet students various learning needs. This is in agreement with the three principles of UDL. This is also in agreement with the assertion that technologies such as iPads have different ways to engage students (Fisher, D., Fisher, D., & Frey, 2017).

Even though students individually used iPads for math learning, they still needed teacher and peer support. The majority of students said they asked for teacher assistance when they faced challenges of solving word problems while using iPad apps for math learning activities. Some students shared that they sought teacher assistance when faced with having technical difficulties during iPad-use. The majority of students also shared that they sought for assistance from both teachers and peers when challenged by math problems while using iPad apps. In one lesson observation, I witnessed one student having technical difficulties and Mr. Williams assisting him overcome the difficulties. Hilton (2018) maintained that the mere integration of technology such as iPads into a math curriculum does not improve student learning experiences. Instructor facilitation plays an essential role in technology integration into the curriculum (Shanley et al., 2017). Pedagogical approaches used by teachers still played an important role in impacting students' learning experiences with iPad-use in a mathematics curriculum (Calder & Campbell, 2016; Hilton, 2018). The finding confirms the importance of teacher technology, pedagogical, and content knowledge in implementing technology use in the curriculum as explained by the TPACK model (Meyer, Rose, & Gordon, 2014).

Another finding was that students experienced engagement with math Common Core learning materials while using iPad apps. This affirms findings from several studies

(Byno, 2014; Swicegood, 2015; Calder & Campbell, 2016; Weisel, 2017; Kaur et al., 2017, Retalis, Paraskeva, Alexiou, Litou, Sbrini, & Limperaki, 2018) that student engagement in math learning improved with use of iPad apps. Mobile technologies such as iPads support student engagement with learning materials to acquire a deeper understanding of core subjects (Retalis, et al., 2018). The results of student interviews suggested that students had a deeper understanding of Common Core standards-based math problems. Student work samples corroborated student-interview- results. On student work samples, students demonstrated their ability to analyze word problems by using the accessibility options of apps such as Nearpod to underline the questions in word problems, highlight and circle key information, and using the touch screen to write notes or annotations that demonstrated their thought processes. Use of engaging accessibility options promoted positive student work habits such as staying on task. The majority of students shared that use of iPad apps enabled them to stay on task and complete assignments, and that iPad apps made learning enjoyable. Retalis, et al. (2018) stated that mobile technologies such as iPads support student engagement and make learning enjoyable. The finding concurs John Dewey (1938) experiential learning theory. Carr (2012) described experiential learning as a student centered pedagogical strategy that motivates students to have a participatory role in learning activities. David Kolb (2014) describes experiential learning as including the processing continuum that identifies how learners process information.

Another impact of iPad-use on the experiences of students with Common Core standards-based math curriculum was that students experienced using the iPad as an

assessment tool. Researchers support the fact that there should be a balance between mobile learning, aligning the curriculum, and assessment (Retalis, et al. 2018). Kaur et al. (2017) also asserted that iPad apps served as a tool for informal assessment. In this study, the special education teacher confirmed that iPad apps give instant feedback to students and that both teachers use this to monitor students' progress towards achieving their IEP math goals.

Students also experienced some challenges. Students reported experiencing challenges including the slow internet and limited battery life. Other challenges that I observed included use of the text-to-speech accessibility option on the iPad. Challenges experienced by iPad users in this study affirm the barriers and limitations of using mobile devices in learning (Khalid, Kilic, Christoffersen, & Purushothaman, 2015; Khaddage, Knezek, Norris, & Soloway, 2015). Both teachers were using the accommodation to read to students with learning disabilities but it took them some time to read to all students, one at a time. The TPACK model of technology integration emphasizes a balance in technological know-how, teaching strategies, and subject matter knowledge a meaningful incorporation of technology in the curriculum. The challenge of lack knowledge by the teachers on the use of the accessibility option of text-to-speech on the iPad highlights the value of the technological knowledge concept of the TPACK model. Connor and Beard (2015) advised that an effective implementation of technology integration may not be feasible without the provision of teacher training and support. Both teachers shared that the school district is shifting to using the Chromebook and that there is minimal focus to iPad-use training.

Limitations of the Study

There were several limitations because of the diversity of population in the setting. This study was carried out in a large school district with 11 middle schools. Few schools are currently using the iPad because of the Chromebook initiative that the school district has embarked on. Therefore, this study was a single case study of two 8th grade inclusion classes taught by two co-teachers at one school site. The two co-teachers were not representative of all inclusion teachers that use iPads in a math Common Core standards-based curriculum. Only 8 students who met the criteria participated in the study and their experiences with iPads might not be the same experiences with other inclusion students taught by different teachers. A single case study and a limited number of teacher and student participants allowed for an in-depth collection and analysis of data. It also allowed for triangulation including collecting data through individual interviews, direct lesson observations, student work samples, and lesson plans. Using multiple sources of data allowed for triangulation to validate the results.

Recommendations

Even though research findings revealed several benefits of using technology such as iPad apps, it also revealed that there are some challenges and factors that influence use of iPads for math in a Common Core inclusion math class. I recommend that educators continue improving their knowledge on Common Core content standards, technological, and pedagogical strategies to make sound technologically related instructional decisions. One benefit that could improve teachers' technology knowledge is continued training in all types of technology that are used in schools.

School leaders should take the responsibility of consistent professional development in technology integration to include all types of technologies in use in the schools. With an increase in innovative apps coming into the market, I recommend that school leaders develop a system of keeping in pace with new apps that have the potential of helping all students have a deeper understanding of Common Core standards-based math concepts. To reduce the amount of time that teachers spend researching apps, school leaders can frequently provide teacher with an updated list of relevant math apps. This would give teachers time to focus on how to effectively use technology to complement their teaching strategies and subject matter knowledge in implementing the Common Core standards-based math curriculum and to effectively help students with math learning disabilities.

Recommendations for Future Research

For future research my recommendation is that researchers should involve more teacher and student participants in this kind of study, and use a multiple case study approach. This will provide more information that can be transferred to comparable situations and applied in analogous context. I also recommend that the study should include more than one instructional unit to get more information on the experiences of teachers with choice of apps for different instructional units. The recommendations above may provide a better understanding of inclusion teachers and special education students' experiences with using iPad apps in a Common Core math curriculum.

This study was conducted in a school in a low socio-economic neighborhood. Student participants shared one of their challenges as limited time of use of iPad apps

because they could not take the iPads home. Longer exposure to use of apps may yield different results on student experiences with use of apps for the Common Core standards-based curriculum. The recommendation is to also conduct the study in schools located in neighborhood with high socio-economic status and middle income neighborhoods to represent the spectrum of socioeconomic levels.

Researchers can also provide a specific app for use over a specified period of time to investigate teachers' and students' experiences. An app different from Nearpod may yield different results on user experiences. The last but not least recommendation is that school leaders provide teachers with research-based apps that support the learning objectives of Common Core standards-based math curriculum. In this research, teachers chose relevant apps that could be used as tools to meet lesson objectives and support learning for all students.

Implications

Positive social change involves application of approaches, ideas, and actions to improve both social and human conditions (*Walden University Student Handbook*, 2015). Findings from both teacher and student experiences with iPad-apps-use in an inclusion mathematics class can guide changes in technology integration approaches, and technological and pedagogical strategies during iPad-use in math classrooms. Educators and other special education stakeholders can gain insight on the value of teacher technological know-how, teaching strategies, and subject matter knowledge in integrating technology with apps, such as iPads, in a Common Core standards-based curriculum.

Findings from both teacher and student experiences revealed the importance of lesson planning and choice of apps to support learning of specific content standards in mathematics and to provide access to Common Core standards-based curriculum to all students. Choice of apps with activities that have an appropriate level of challenge and address Common Core math concepts is essential. Such apps can be used to add to teacher instruction to help students increase their conceptual understanding of Common Core math standards. The findings of this study add to the understanding and importance of technology integration and use of apps as an aide to deeper learning of Common Core math standards. Findings from student experiences underscored the importance of teacher pedagogical strategies, including giving students one-on-one instructional support in content knowledge and technological knowledge during use of apps for learning.

The stakeholders can also gain insight on technology integration with a UDL lens to provide accommodations and access to the Common Core math curriculum to students with learning disabilities. Using the UDL lens can give insight on how to take advantage of the accessibility functions that come with the 21st century technologies such as iPads. Providing accommodations through taking advantage of the inbuilt accessibility functions of the iPads can create a student-centered learning environment that can result in a deeper understanding of math concepts (Minshew & Anderson, 2015).

A paradigm shift in the provision of professional development by school leaders, to provide training in all technologies used in schools, can lead to an efficient use of technology in a Common Core standards-based curriculum to support students with math learning disabilities. Professional development and efficiently implemented technology

integration can improve the experiences of both teachers and students using apps for the Common Core math curriculum. When correctly implemented, use of math apps and the accessibility functions, such as text-to-speech, can improve special education students' learning experiences and academic achievement. Teachers and also do professional development through peer collaboration and teacher demonstrations of use of accessibility functions of different apps on an iPad. When teachers are continually given professional development on mathematics apps, teachers' experiences with using technologies such as iPad apps for mathematics would improve.

Conclusion

The purpose of this qualitative single case study was to investigate the experiences of middle school inclusion teachers and special education students with the use of iPad apps in a Common Core standards-based math curriculum. The results of this study add to the literature on technology integration in a Common Core math curriculum to meet the needs of students with math learning disabilities. The results of this study revealed that inclusion teachers and special education students with math learning disabilities had more positive than negative experiences using iPad apps in a Common Core standards-based unit on creating and solving equations using word problems.

This study revealed that iPad apps were used as assistive technology to support students with math learning disabilities by providing accommodations such as accessible functions that were used to underline, circle, highlight, and write annotations on word problems. This can allow inclusion teachers to understand students' thinking process as they solve Common Core standards math word problems and can enable them to plan for

interventions and revise pedagogical strategies. Analyzing student explanations and thinking process in math problem solving can be a powerful tool in influencing pedagogical practices (Soto & Ambrose, 2016). The results also revealed that iPad apps provided students with access to the Common Core standards-based learning material. Educators can use this information to select math apps as deemed fit with math content standards and able to reduce learning barriers for students with math learning disabilities.

This study also expands the understanding of technology integration in as far as addressing student learning behaviors. Results from both teacher and student data analysis revealed that use of iPad apps improved special education students' ability to stay on task and complete assignments resulting in improved academic achievement. IPad-app assisted instruction has the ability to change special education students' attitude, confidence, and engagement with math learning. The teacher's role in choosing iPad apps appropriate for math content standards, designing pedagogy to meet learning needs of all students, and integrating technology as a supplement to a Common Core standards-based math curriculum, may have the ability to change special education students' learning experiences, math classroom environments, and a positive impact on technology integration in the education field.

References

Ahmed, A. (2018). Perceptions of using assistive technology for students with disabilities in the classroom. *International Journal of Special Education*, *33*(1), 129-139. http://www.internationaljournalofspecialeducation.com/

Aksu, H. H. (2014). An evaluation into the views of candidate mathematics teachers over "Tablet Computers" to be applied in secondary schools. *Turkish Online Journal of Educational Technology*, *13*(1), 47-55. http://www.tojet.net/

Alase, A. (2017). The interpretative phenomenological analysis (IPA): A guide to a good qualitative research approach. *International Journal of Education and Literacy Studies*, *5*(2), 9-19. http://www.journals.aiac.org.au/index.php/IJELS

Al Hazmi, A. N., & Ahmad, A. C. (2018). Universal Design for Learning to support access to the general education curriculum for students with intellectual disabilities. *World Journal of Education*, *8*(2), 66-72. http://www.sciedupress.com/journal/index.php/wje

Allen, M. L., Hartley, C., & Cain, K. (2016). IPads and the use of apps by children with autism spectrum disorder. Do they promote learning? *Frontiers in Psychology, 7,* 1305. doi:10.3389/fpsyg.2016.01305

Al-Mashaqbeh, I. F. (2016). IPad in elementary school math learning setting. *International Journal of Emerging Technologies in Learning*, *11*(2), 48-52. doi: 10.3991/ijet.v11i2.5053

Alnahdi, G. (2014). Assistive technology in special education and the Universal Design for Learning. *Turkish Online Journal of Educational Technology*, *13*(2), 18-23. http://www.tojet.net

Alzrayer, N., Banda, D. R., & Koul, R. K. (2014). Use of iPad/iPods with individuals with autism and other developmental disabilities: A meta-analysis of communication interventions. *Review Journal of Autism and Developmental Disorders, 1*(3), 179-191. doi:10.1007/s40489-014-0018-5

Anderson, S., Griffith, R., & Crawford, L. (2017). TPACK in special education: Preservice teacher decision making while integrating iPads into instruction. *Contemporary Issues in Technology & Teacher Education, 17*(1), 91-127. https://www.citejournal.org

Baker, J. M., Moyer-Packenham, P. S., Tucker, S. I., Shumway, J.F., Jordan, K. E., & Gillam, R. B. (2018). The brain's response to digital math apps: A pilot study examining children's cortical responses during touch-screen interactions. *Journal of Computers in Mathematics & Science Teaching, 37*(1), 69-86. http://www.aace.org/pubs/jcmst

Beal, C. R., & Rosenblum, L. P. (2015). Use-of an accessible iPad app and supplemental graphics to build mathematics skills: Feasibility study results. *Journal of Visual Impairment & Blindness, 109*(5), 383-394. doi:10.1177/0145482X1510900507

Bicehouse, V., & Faieta, J. (2017). IDEA at age forty. Weathering common core standards and data driven decision making. *Contemporary Issues in Education Research, 10*(1), 33-44. doi:10.19030/cier.v10i1.9878

Bottge, B. A., Toland, M. D., Gassaway, L., Butler, M., Choo, S., Griffen, A. K., & Ma, X. (2015). Impact of enhanced anchored instruction in inclusive math classrooms. *Exceptional Children, 81*(2), 158-175. doi:10.1177/0014402914551742

Braun, V., Clarke, V., Hayfield, V., & Terry, G. (2019). Thematic analysis. In Liamputtong, P. (ed.), *Handbook of research methods in health social sciences* (pp. 843-860). Springer, Singapore. doi:10.1007/978-981-10-5251-4_103

Bryant, B., Ok, M., Kang, E., Kim, M., Lang, R., Bryant, D., & Pfannestiel, K. (2015). Performance of fourth-grade students with learning disabilities on multiplication facts comparing teacher-mediated and technology-mediated interventions: A preliminary investigation. *Journal of Behavioral Education, 24*(2), 255-272. doi: 10.1007/s10864-015-9218-z

Byno, K. J. (2014). *Integrating iPad technology into the classroom: A study investigating experiences educators encounter* (Doctoral Dissertation). Retrieved from ProQuest Dissertations & Theses Global (3622844)

Calder, N., & Campbell, A. (2016). Using mathematics apps with reluctant learners. *A Digit Experience in Mathematics Education, 2*(1), 50-59. doi:10/1007/s40751-016-0011-y

Carr, J. M. (2012). Does math achievement happen when iPads and game-based learning are incorporated into fifth-grade mathematics instruction? *Journal of Information Technology Education, 11*(1), 269-286. doi:10.28945/1725

Charmaz, K. (2008). Grounded theory as an emergent method. In N.S. Hess-Bieber & P Leavy (Eds.), *The handbook of emergent methods.* pp. 155-170. New York, NY; Guidford.

Chandler, M. & Tsukuyama, H. (2014). Tablets proliferate in nation's classrooms, taking a swipe at the status quo. The Washington Post: Education (May 17).

Ciampa, K. (2014). Learning in a mobile age: an investigation of student motivation. *Journal of Computer Assisted Learning 30*(1), 82-96. doi:10.1111/jcal.12036

Connor, C., & Beard, L. A. (2015). Increasing meaningful assistive technology use in the classrooms. *Universal Journal of Educational Research, 3*(9), 640-642. http://www.hrpup/org/journals

Cook, S. C., & Rao, K. (2018). Systematically applying UDL to effective practices for students with learning disabilities. *Learning Disability Quarterly*, *41*(3), 179–191. doi:10.1177/0731948717749936

Cosmah, M., & Saine, P. (2013). Targeting digital technologies in common core standards: A framework for professional development. *New England Reading Association Journal, 48*(2), 81-86. Retrieved from https://search-ebscohost-com.ezp.waldenulibrary.org/login.aspx?direct=true&db=eue&AN=86427470&site=eds-live&scope=site

Cramer, E. D., & Gallo, R. F. (2017). Special educators' perceptions of state standards in a large, urban school district. *Journal of Urban Learning, Teaching, and Research, 13,* 34-44. Retrieved from https://search-ebscohost-com.ezp.waldenulibrary.org/login.aspx?direct=true&db=eric&AN=EJ1150164&site=eds-live&scope=site

Creswell, J. W., & Poth, C. N. (2017). *Qualitative Inquiry Research Design: Choosing Among Five Approaches.* Thousand Oaks, California. Sage

Cumming, T. M., Strnadova, I., & Singh, S. (2014). IPads as instructional tools to enhance learning opportunities for students with developmental disabilities: An action research project. *Action Research*, *12*(2), 151-176. doi:10.1177/1476750314525480

Davidson, L. Y. J., Richardson, M., & Jones, D. (2014). Teachers' perspective on using technology as an instructional tool. *Research in Higher Education Journal*, 24, 1-25. Retrieved from https://eric.ed.gov/contentdelivery/servlet/ERICServlet?accno=EJ1064110

De Wit, E., Visser-Bochane, M. I., Steenbergen, B., van Dijk, P., van der Schans, C. P., & Luinge, M. R. (2016). Characteristics of auditory processing disorders: A systematic review, *59*(2), 384-413. doi:10.1044/2018_JSLHR-H-17-0412

Del Moral-Perez, M.E., Fernandez-Garcia, L. C., & Guzman-Duque, A.P. (2015). Videogames: Multisensory incentives boosting multiple intelligences in primary education. *Electronic Journal of Research in Educational Psychology, 13*(2), 243-270. Retrieved from https://search-ebscohost-

com.ezp.waldenulibrary.org/login.aspx?direct=true&db=eric&AN=EJ1074117&site=eds-live&scope=site

Dewey, J. (1938). *Experience and Education*. New York: Collier Books.

Ditzler, C., Hong, E., & Strudler, N. (2016). How tablets are utilized in the classroom. *Journal of Research on Technology in Education*, *48*(3), 181-193. doi:10.1080/15391523.2016.1172444

Domingo, M.G., & Gargante, A. B. (2016). Exploring the use of educational technology in primary education: Teachers' perception of mobile technology learning impacts and applications' use in the classroom. *Computers in Human Behavior*, *56*, 21-28. doi:10.1016/j.chb.2015.11.023

Epps, T. S. (2016). Special education teachers' lived experiences in the implementation of the iPad as an instructional tool for students with intellectual disabilities (Order No. 10109985). Available from ProQuest Dissertations & Theses Global. (1796857993). Retrieved from http://search.proquest.com.ezp.waldenulibrary.org/docview/1796857993?accountid=14872

Erbes, S., Lesky, S., & Myers, J. (2016). Teachers exploring mobile device integration: A case study of secondary teachers' responses to iPads in the classroom. *Journal of Information Technology Education*: Research, 15, 503-516. Retrieved from http://www.informingscience.org/Publications/3574

Erdem, R. (2017). Students with special educational needs and assistive technologies: A literature review. *Turkish Online Journal of Educational Technology*, *16*(1), 128-

146. http://www.tojet.net/

Erdogan, N., & Stuessy, C. (2015). Examining the role of inclusive STEM schools in the college and career readiness of students in the United States: A multi-group analysis on the outcome of student achievement. *Educational Sciences: Theory & Practice, 15*(6), 1517-1529. doi:10.12738/estp.2016.1.0072

Etscheidt, S. L. (2016). Assistive technology for students with disabilities: A legal analysis of issues. *Journal of Special Education Technology, 31*(4), 183-194.

Exceptional students and disability information (n.d). Retrieved from https://www.naset.org/index.php?id=exceptionalstudents2

Fisher, D., & Frey, N. (2017). Digital tools to broaden learning: New technologies can give students multiple means of engagement, action, and representation. *Educational Leadership, 74*(7), 80-82. http://www.ascd.org/publications/educational-leadership/apr17/vol74/num07/Digital-Tools-to-Broaden-Learning.aspx

Flewitt, P., Kucirkova, N., & Messer, D. (2014). Touching the virtual, touching the real, iPads and enabling literacy for students experiencing disability. *Australian Journal of Language Literacy, 32*(2), 107-116. Retrieved from https://search-ebscohost-com.ezp.waldenulibrary.org/login.aspx?direct=true&db=eue&AN=96256130&site=eds-live&scope=site

Freeman, J., Yell, M. L., Shriner, J. G., & Katsiyannis, A. (2019). Federal policy on improving outcomes for students with emotional and behavioral disorders: Past,

present, and future. *Behavioral Disorders, 44*(2), 97-106. doi:10.1177/0198742918814423

Fuchs, L. S., Fuchs, D., Compton, D. L., Wehby, J., Schumacher, R. F., Gersten, R., & Jordan, N. C. (2015). Inclusion versus specialized intervention for very-low-performing students: What does access mean in an era of academic challenge? *Exceptional Children*, *81*(2), 134-157. doi:10.1177/0014402914551743

Goransson, K., & Nilholm, C (2014). Conceptual diversities and empirical short comings-a critical analysis of research in inclusive education. *European Journal of Special Needs Education*, 28(3), 265-280. doi:10.1080/08856257.2014.933545

Grant, M. M., Tamim, S., Brown, D. B., Sweeney, J. P., Ferguson, F. K., & Jones, L. B. (2015). Teaching and learning with mobile computing devices: Case study in K-12 classrooms. *Tech-Trends*, 59(4), 32-45. doi:10.1007/s11528-015-0869-3

Hall, T. E, Cohen, N., Vue, G., & Ganley, P. (2015). Addressing learning disabilities with UDL and technology: A strategic reader. *Learning Disability Quarterly*, 38(2), 72–83. doi:10.1177/0731948714544375

Harris K. R., & Graham, S (2019). *What works for special needs learners. Teaching mathematics to middle school students with learning disabilities.* New York, NY. Guildford Publications. https://ijemst.net/index.php/ijemst

Harrison, T. R., & Lee, H. S. (2018). iPads in the mathematics classroom: Developing criteria for selecting appropriate learning apps. *International Journal of Education in Mathematics, Science Today*, *6*(2), 155-172. https://ijemst.net/index.php/ijemst

Hernandez, A. (2018). California Department of Education. CCSS mathematics resources. Retrieved from https://www.cde.ca.gov/re/cc/mathresources.asp

Hilton, A. A. H. (2018). Engaging primary school students in mathematics: Can iPads make a difference? *International Journal of Science & Mathematics Education*, *16*(1), 145–165. doi:10.1007/s10763-016-9771-5

Hitchcock, C., Meyer, A., Rose, D., & Jackson, R. (2002). Providing new access to the general curriculum: Universal design for learning. *TEACHING Exceptional Children*, *35*(2), 8–17. doi:10.1177/004005990203500201

Howard, B. J. (2017). Effects of one-to-one iPad initiative program on 11th grade standardized test scores (Order No. 10603907). Available from Dissertations & Theses @ Walden University. (1940482784).

Hutchison, A., & Colwell, J. (2016). Preservice teachers' use of the technology integration planning cycle to integrate iPads into literacy instruction. *Journal of Research on Technology in Education*, *48*(1), 1-15. doi:10.1080/15391523.2015.1103146

Janesick, V. J. (2016). *Stretching exercises for qualitative researchers*. Thousand Oaks: Sage Publications.

Kaczorowski, T. L., Hashey, A. I., & Di Cesare, D. M. (2019). An exploration of multimedia supports for diverse learners during core math instruction. *Journal of Special Education Technology, 34*(1), 41-54. doi:10.1177/0162643418781298

Karlsudd, P. (2014). Tablets as learning support in special schools. *Problems of Education in the 21st Century*, *59*, 49-58.

Kaufman, D. & Kumar, S. (2018). Student perceptions of a one-to-one iPad program in an urban high school. *International Journal of Research in Education and Science (IJRES), 4*(2),454-470. doi:10.21890/ijres.428267.

Kaur, D., Koval, A., & Chaney, H. (2017). Potential of using iPad as a supplement to teach math to students with learning disabilities. *International Journal of Research in Education and Science*, *3*(1), 114–121. https://www.ijres.net/index.php/ijires/article/view/140

Khaddage, F., Knezek, G., Norris, C., & Soloway, E. (2015). Barriers and limitations of mobile device integration: The case of Nan Chiau primary school (Singapore). In Society for Information Technology & Teacher Education International Conference (Vol. 2015, No. 1, pp. 2420-2424). Retrieved from http://site.aace.org

Khalid, M., Kilic, G., Christoffersen, J., & Purushothaman, A. (2015). Barriers to the integration and adoption of iPads in schools: A systematic literature review based on the philosophy of "think global, act local." *In Global Learn*, *15*(1), 58-67. Retrieved from http://www.aace.org/conf/glearn/

Kirkpatrick, L., Brown, H. M., Searle, M., Smyth, R. E., Ready, E. A., Kennedy, K. (2018). Impact of a one-to-one iPad initiative on grade 7 students' achievement in language arts, mathematics, and learning skills. *Computers in Schools, 35*(3), 171-185. https://doi-org.ezp.waldenulibrary.org/10.1080/07380569.2018.1491771

Koehler, M. J., Mishra, P., Kereluik, K., Shin, T. S., & Graham, C. R. (2014). The technological pedagogical content knowledge framework. In *Handbook of Research on Educational Communications and Technology* (pp. 101-111).

Springer New York. doi:10.1007/978-1-4614-3185-5_9

Kolb, D. A. (2014). *Experiential learning: Experience as a source of learning and development.* Upper Saddle River, New Jersey: Pearson Education, Inc.

Kontkanen, S., Dillon, P., Valtonen, T., Eronen, L., Koskela, H., & Vaisanen, P. (2017). Students' experiences of learning with iPads in upper secondary school - a base for proto-TPACK. *Education & Information Technologies*, *22*(4), 1299–1326. https://doi-org.ezp.waldenulibrary.org/10.1007/s10639-016-9496-7

Kucirkova, N., Messer, D., Sheehy, K., & Fernandez-Panadero, C. (2014). Children's engagement with educational iPad apps: Insights from a Spanish classroom. *Computers & Education*, *71,* 175-184. doi: 10.1016/j.compedu.2013.10.003

Larkin, K. (2014). iPad apps that promote mathematical knowledge? Yes, they exist! *Australian Primary Mathematics Classroom*, *19*(2), 28-32.

Larkin, K., Jorgensen, R. (2016). "I hate maths: why do we need to do maths?" Using iPad video diaries to investigate attitudes and emotions towards mathematics in year 3 and year 6 students. *International Journal of Science and Mathematics Education, 14*(5), 925-944. doi:10.1007/s10763-015-9621-x.

Lee, J., Choi, H. (2017). What affects learners' higher-order thinking in technology-enhanced learning environments? The effects of learner factors. *Computers & Education, 115,* 143-152.

Ling, G. (2016). Does it matter whether one takes a test on an iPad or a desktop computer? *International Journal of Testing*, *16*(4), 352-377.

doi:10.1080/15305058.2016.1160097

Liu, M., Navarrete, C. C., Scordino, R., Kang, J., Ko, Y., & Lim, M. (2016). Examining teachers' use of iPads, comfort level, perception, and use. *Journal of Research on Technology in Education, 48*(3), 159-180. doi:10.1080/15391523.2016.1175853

Maich, K., & Hall, C. (2016). Implementing iPads in the inclusive classroom setting. *Intervention in School & Clinic*, *51*(3), 145-150. doi:10.1177/1053451215585793

Maich, K., Hall, C., van Rhijn, T., & Henning, M. (2017). Teaching and learning in two iPad-infused classrooms: A descriptive case study of a dual classroom, school-based pilot project. *Exceptionality Education international (27)*2, 2-25.

Mango, O. (2015). iPad-use and student engagement in the classroom. *Turkish Online Journal of Educational Technology*, *14*, 53-57. Retrieved from https: https://eric.ed.gov/?id=EJ1057341

Marita, S., & Hord, C. (2017). Review of mathematics interventions for secondary students with learning disabilities. *Learning Disability Quarterly*, *40*(1), 29-40. doi:10.1177/0731948716657495

Marshall, C., Rossmann, G. B., (2016). *Designing qualitative research*. Thousand Oaks, CA: Sage Publications.

Maxwell, J. (2013). *Qualitative research: A guide to design and implementation*. San Francisco, CA: Jossey-Bass.

McGinn, P. (2016). From No Child Left Behind to Every Student Succeeds Act: Federalism and the Education Legacy of the Obama Administration. *The Journal of Federalism 46* (3), 392-415. doi:10.1093/publius/pjw014

McKnight, K., O'Malley, K., Ruzic, R., Horsley, M. K., Franey, J. J., & Bassett, K. (2016). Teaching in a digital age: How educators use technology to improve student learning. *Journal of Research on Technology in Education*, *48*(3), 194-211. doi:10.1080/15391523.2016.1175856

McMahon, D. (2014). Technology in action. *Journal of Special Education Technology*, *29*(2), 39-49. doi:10.1177/016264341402900204

Meyer, A., Rose, D. H., & Gordon., D. (2014). Universal design for learning: Theory and practice. Wakefield, MA: Center for Applied Special Education Technology. Retrieved from https://udltheorypractice.cast.org

Miles, M., Huberman, A. M., & Saldana, J. (2014). *Qualitative Data Analysis. A methods Sourcebook.* Thousand Oaks, CA: Sage Publications, Inc.

Miller, T. (2018). Developing numeracy skills using interactive technology in a play-based learning environment. *International Journal of STEM Education, 5*(1), 1-11. doi:10.1186/s40594-018-0135-2

Minshew, L., & Anderson, J. (2015). Teacher self-efficacy in 1:1 iPad integration in middle school science and math classrooms. *Contemporary Issues in Technology & Teacher Education, 15*(3), 7. https://www.citejournal.org/publication/volume-15/issue-3-15/

Moldt, S. R. (2016). Making the grade: A ground-level analysis of New York state's teacher performance review under the APPR. *Brigham Young University Education & Law Journal*, (2), 217-262. Retrieved from https://heinonline.org/HOL/LandingPage?handle=hein.journals/byuelj2016&div=

13&id=&page=

Mulcahy, C. A., Maccini, P., Wright, K., & Miller, J. (2014). An examination of intervention research with secondary students with EBD in light of common core state standards for mathematics. *Behavioral Disorders, 39*(3), 146-164. doi:10.1177/019874291303900304

Murphy, D. (2016). A literature review: The effect of implementing technology in a high school mathematics classroom. *International Journal of Research in Education and Science, 2*(2), 295-299. https://www.ijres.net/index.php/ijres

National Assessment of Education Progress-NAEP, (2015). Mathematics Assessment. Retrieved from https://nces.ed.gov/nationsreportcard/mathematics/

National Education Technology Plan, (2016). Retrieved from https://tech.ed.gov/netp/

Nepo, K. (2017). The use of technology to improve education. *Child & Youth Care Forum, 46*(2), 207-221. doi:10.1007/s/10566-016-9386-6

Ocumpaugh, J., San Pedro, M. O., Lai, H., Baker, R. S., & Borgen, F. (n.d.). Middle School Engagement with Mathematics Software and Later Interest and Self-Efficacy for STEM Careers. *Journal of Science Education and Technology, 25*(6), 877–887. doi:10.1007/s10956-016-9637-1

Ockert, D. M., (2014). The influence of technology in the classroom: An analysis of an iPad and video intervention on JHS students' confidence, anxiety, and FL WTC. *JALT CALL Journal 10*(1), 49-68. https://journal.jaltcall.org/articles/167

Ogbuanya, T. C., & Efuwape, B. M. (2018). Technology-Aided Learning Environment: An Investigation into Electrical/Electronics Students' Instructional Preferences,

Attitude and Approaches to Learning. *South African Journal of Education*, *38*. https://www.ajol.info/index.php/saje/article/view/182909/172284

Ok. W. M. (2018). Use of iPads as assistive technology for students with disabilities. *Tech Trends: Linking Research & Practice to Improve Learning, 62*(1), 95-102. doi:10.1007/s11528-017-0199-8

Ok, M. W., & Bryant, D. P. (2016). Effects of a strategic intervention with iPad practice on the multiplication fact performance of fifth-grade students with learning disabilities. *Learning Disability Quarterly*, *39*(3), 146-158. doi:10.1177/0731948715598285

Ok, M. W., & Kim, W. (2017). Use of iPads and iPods for academic performance and engagement of preK–12 students with disabilities: A research synthesis. *Exceptionality, 25*(1), 54-75. doi:10.1080/09362835.2016.1196446

O'Malley, P., Lewis, M. E. B., Donehower, C., & Stone, D. (2014). Effectiveness of using iPads to increase academic task completion by students with autism. *Universal Journal of Educational Research*, *2*(1), 90-97. Retrieved from https://www.learntechlib.org/p/160634

Olofson, M. W., Swallow, M. J., & Neumann, M. D. (2016). TPACKing: A constructivist framing of TPACK to analyze teachers' construction of knowledge. *Computers & Education, 95,* 188-201. doi:10.1016/j.compedu.2015.12.010

Patton, M. Q., (2015). *Qualitative Research & Evaluation Methods* (4th ed.). Thousand Oaks, CA: Sage Publications, Inc.

Pepe, T. M. (2016). Teacher perceptions and attitudes of classroom technology integration related to iPad training (Order No. 3746446). Available from Dissertations & Theses @ Walden University. (1755882920).

Perry, D. R., & Steck, A. K. (2015). Increasing student engagement, self-efficacy, and meta-cognitive self-regulation in the high school geometry classroom: Do iPads help? *Computers in the Schools, 32*(2), 12-143. doi. 10.1080/70385069.2015.1036650

Persada, S. F., Miraja, B. A., & Nadlifatin, R. (2019). Understanding the generation z behavior on D-learning: A unified theory of acceptance and use of technology (UTAUT) approach. *International Journal of Emerging Technologies in Learning, 14*(5), 20-23. doi.10.3991/ijet.vi4i05.9993.

Pettit, M. A. M. (2014). *A case study of the implementation of iPads with high school students at two charter high schools in southern California* (Order No. 3630494). Available from ProQuest Central; ProQuest Dissertations & Theses Global. (1564023518). Retrieved from https://search-proquest-com.ezp.waldenulibrary.org/docview/1564023518?accountid=14872

Pitchford, N. J., Kamchedzera, E., Hubber, P. J., & Chigeda, A. L. (2018). Interactive apps promote learning of basic mathematics in children with special needs and disabilities. *Frontiers in Psychology. https://doi-org.ezp.waldenulibrary.org/10.3389/fpsyg.2018.00262*

Powell, S. (2014). Choosing iPad apps with a purpose: Aligning skills and standards. *Teaching Exceptional Children*, *47*(1), 20-26. doi:10.1177/0040059914542765

Powell, S. (2015). Connecting evidence-based practice with implementing opportunities in special education mathematics preparation. *Intervention in School and Clinic, 51*(2), 90-96. doi:10.1177/1053451215579269.

Rao, K., Ok, M. W., & Bryant, B. R. (2014). A Review of research on universal design educational models. *Remedial & Special Education*, *35*(3), 153-166. doi:10.1177/0741932513518980

Rao, K., Smith, S.J., Lowrey, K. A. (2017). UDL and intellectual disability: What do we know and where do we go? *Intellectual and developmental disabilities*. *55*(1), 37-47. doi:10.1352/1934-9556-55.1.37

Retalis, S., Paraskeva, F., Alexiou, A., Litou, Z., Sbrini, T., & Limperaki, Y., (2018). Leveraging the 1:1 iPad approach for enhanced learning in the classroom. *Educational Media International, 55*(3), 213-230. doi:10.1080/09523987.2018.1512463

Rosenberg, J. M., & Koehler, M., (2015). Context and technological pedagogical content knowledge (TPACK): A systematic review. *Journal of Research on Technology in Education, 47*(3), 186-210.

Ryan, T., & Bagley, G. (2015). Nurturing the integration of technology in education. *Journal of Theory and Practice in Education*, *11*(1), 33-50.

Salend, S. J, & Whittaker, C. R. (2017). UDL: A blueprint for learning success. *Educational Leadership, 74*(7), 59-63. Retrieved from http://www.ascd.org/publications/educational-leadership

Satsangi, R., Hammer, R., & Hogan, C. D. (2018). Studying virtual manipulatives paired with explicit instruction to teach algebraic equations to students with learning disabilities. *Learning Disabilities Quarterly, 41*(4), 227-242. doi:10.1177/0731948718769248.

Schuetz, R. L., Biancarosa, G., & Goode, J. (2018). Is technology the answer? Investigating students' engagement in math. *Journal of Research on Technology in Education, 50*(4), 318-332. doi:10.1080/15391523.2018.1490937

Schulte, A. C., & Stevens, J. J. (2015). Once, sometimes, or always in special education: mathematics growth and achievement gaps. *Exceptional Children, 81*(3), 370-387. doi:10.1177/0014402914563695

Shanley, L., Strand Carry, M., Clarke, B., Guerreiro, M. A., & Thier, M. (2017). Instructors technology experience and iPad delivered intervention implementation: A mixed methods replication study. *Educational Technology Research and Development, 65*(4), 815-830. doi.10.1007/s/11423-016-9488-8

Smith, J. A., Flowers, P., & Larkin, M. H. (2013). *Interpretative phenomenological analysis: theory, method and research*. Los Angeles: Sage

Smith, C. A., & Santori, D. (2015). An exploration of iPad-based teaching and learning: How middle-grades teachers and students are realizing the potential. *Journal of*

Research on Technology in Education, *47*(3), 173-185. doi: 10.1080/15391523.2015.1047700

Soffer, T., & Yaron, E. (2017). Perceived learning and students' perceptions toward using tablets for learning: The mediating role of perceived engagement among high school students. *Journal of Educational Computing Research, 55*(7), 951-973. doi:10.1177/0735633117689892

Soto, M. M., & Ambrose, R. (2016). Making students' mathematical explanations accessible to teachers through the use of digital recorders and iPads. *Learning, Media & Technology*, *41*(2), 213-232. doi:10.1080/17439884.2014.931867

Stacy, S. T., Cartwright, M., Arwood, Z., Canfield, J. P., & Kloos, H. (2017). Addressing the math-practice gap in elementary school: Are tablets a feasible tool for informal math practice? *Frontiers in Psychology*, *8.* doi: 10.3389/fspsyg.2017.00179

Stultz, L. S. (2017). Computer-assisted mathematics instruction for students with specific learning disability: A review of the literature. *Journal of Special Education Technology (32)*4, 210-219. doi:10.1177/0162643417725881

Swanson, H. L., Olide, A.F., & Kong, J. E. (2018). Latent class analysis of children with math difficulties and/or math learning disabilities: Are these cognitive differences? *Journal of Educational Psychology, 110*(7), 931-951. doi: 10.1037/edu0000252

Swicegood, G. P. (2015). *An investigation of the impact of iPad usage on elementary mathematical skills and attitudes* (Doctoral Dissertation). Retrieved from ProQuest http://ezp.waldenulibrary.org (3728424)

Tan, P., & Kastberg, S. (2017). Calling for research collaborations and the use of disability studies in mathematics education. *Journal of Urban Mathematics Education, 10*(2), 25-38. Retrieved from http://ed-osprey.gsu.edu/ojs/index.php/JUME/article/view/321

Thurlow, M. L., Wu, Y., Lazarus, S.S., Ysseldyke, J.E. (2016). Special Education-non-special education achievement gap in math: Effects of reporting methods analytical techniques and reclassification. *Exceptionality, 24*(1), 32-44. doi:10.1080/09362835.2014.986614

Townsend, M. B. (2017). *iPads in K-12 schools: A grounded theory study of value* (Order No. 10270075). Available from ProQuest Dissertations & Theses Global. (1896531055). Retrieved from http://search.proquest.com.ezp.waldenulibrary.org/docview/1896531055?accountid=14872

Vitelli, E. M. (2015). Universal design for learning: Are we teaching it to pre-service general education teachers? *Journal of Special Education Technology, 30*(3), 166-178. doi:10.1177/0162643415618931

Vlachou, J.A., & Drigas, A.S. (2017). Mobile technology for students and adults with autistic spectrum disorders (ASD). *International Journal of Interactive Mobile Technologies, 11*(1), 4-17. doi.10.3991/ijim.v11:1.5922

Watt, S. J., Watkins, J. R., & Abbitt, J. (2016). Teaching algebra to students with learning disabilities. Where have we come and where should we go? *Journal of Learning Disabilities*, *49*(4), 437-447. doi:10.1177/0022219414564220

Wang, Y. H. (2017). Integrating self-paced mobile learning into language instruction: Impact on reading comprehension and learner satisfaction. *Interactive Learning Environments, 25*(3), 397-411. doi:10.1080/10494820.2015.1131170

Wang, S., Hsu, H., Reeves, T.C., Coster, D. C. (2014). Professional development to enhance teachers' practices in using information and communication tools: Lessons learned from a design-based research study. *Computers & Education, 79,* 101-115. doi:10.1016/j.compedu.2014.07.006

Weisel, D. (2017). *Examining the perceived impact of technology on teacher-student math discussions in early elementary classroom* (Doctoral Dissertation) Retrieved from ProQuest Central http://ezp.waldenulibrary (10286850)

Wiersema, J. R., & Godefroid, E. (2018). Interoceptive awareness in attention deficit hyperactivity disorder. *PLoS ONE*, *13*(10), 1–13. doi.10.1371/journal.pone.0205221

Wishard, N. L. (2015). *All iPads, all the time: A qualitative study of high school teachers' experiences with and perspectives on the use of exclusive technology* (Order No. 3687325). Available from ProQuest Dissertations & Theses Global. (1668131102). Retrieved from http://search.proquest.com.ezp.waldenulibrary.org/docview/1668131102?accountid=14872

Woodcock, S., & Hardy, I. (2017). Probing and problematizing teacher professional development for inclusion. *International Journal of Educational Research, 83,* 43-54. doi: 10.1016/j.ijer.2017.02.008

Yin, R. K. (2014). *Case study research: Design and methods* (5th ed.). Thousand Oaks, CA: Sage Publicans, Inc.

Young, K. (2016). Teachers' attitudes to using iPads or tablet computers; implications for developing new skills, pedagogies and school-provided support. *TechTrends, 60*(2), 183-189. doi :10.1007/s11528-016-0024-9

Zakrzewski, J. L. (2016). Using iPads to your advantage. *Mathematics Teaching in The Middle School, 21*(8), 480-483. doi.10.5951/mathteacmiddscho.21.8.0480

Zhang, M., Trussell, R. P., Gallegos, B., & Asam, R. R. (2015). Using math apps for improving student learning: An exploratory study in an inclusive fourth grade classroom. *Techtrends: Linking Research & Practice to Improve Learning, 59*(2), 32-39. doi:10.1007/s11528-015-0837-y

Appendix A: Teacher Invitation Letter

Hello_____

My name is Sitembiso Ncube. I have been an educator teacher in a local school district for 13 years. Currently, I am a student at Walden University. One of doctoral studies requirements is to conduct research. I am therefore conducting a study among eighth-grade inclusion teachers who are currently using iPad apps or any other devices with apps with mathematics learning disabilities students in their Common Core mathematics classes. Because you are currently teaching eighth-grade mathematics inclusion classes, you are receiving an invitation to be part of the study.

I am interested in interviewing inclusion teachers and special education students using iPad apps in eighth-grade Common Core mathematics. To accomplish this purpose, I will interview each inclusion teacher during week one at the beginning of the study. All interviews will be held at a place of your convenience in a closed-door session for privacy. With your consent and student assent, I will do three direct observations of iPad-use in your mathematics class—one in each of the three weeks of the study. I will also ask for the three lesson plans for the observed lessons and any samples of student work. The data collected will be used to describe the impact of the use iPad math apps on teachers and students.

Enclosed you will find the teacher consent form, which explains in details participation conditions. After carefully reading and understanding the all the forms presented kindly sign the consent form if you are volunteering to be part of the study. Please contact me at sitembiso.ncube@waldenu.edu for any question. For any further assistance regarding your rights as a participant, please contact the University Research Participant Advocate directly at (612) 312-1210 or by email at IRB@mail.waldenu.edu

Please email your response to this invitation by (date); and please use the enclosed envelop to return your signed consent form by (date)

Sincerely,
Sitembiso Ncube
Walden University
Ph.D. Doctoral Candidate

Appendix B: Parent/Guardian Consent

Dear (Parent's Name),
My name is Sitembiso Ncube. I am conducting this study as a one of my doctoral studies requirements at Walden University. The purpose of this study is to collect stories from teachers and of students about using iPads in eighth-grade mathematics classrooms.

You are receiving this letter because your child has a math learning disability and is in an inclusion 8th grade math class which uses iPads. This letter is to inform you and seek consent from you. If your child gives assent to be part of the study, s/he will be observed using an iPad in a Common Core mathematics class and will be interviewed to collect his/her experiences with using the iPad apps. The consent form describes the procedures of the study in detail.

Please read this consent form carefully before signing. Please help your child to read and understand the assent form before signing if s/he agrees to participate in the study.

Kindly return the forms using the enclosed envelope—which should be postmarked by (date).

Procedures:
If you give consent for me to include your child in the study as long as s/he gives assent to participating, your child will experience the following.

During three class sessions over a period of three weeks, I will observe participating students who have given assent—including your child—when they are using the iPad apps in their Common Core mathematics class.

In each of the three weeks, your child will be observed once while using the iPad. During the observation, I will record notes about your child's behaviors, engagement level, interactions with other students participating in the study, and interactions with inclusion teachers while using the iPad.

Your child will voluntarily participate in a one-hour individual interview. The individual interview will be conducted either before or after school, depending on your child's preference. The individual interviews will be conducted in week two. All participating students will have an individual interview in a closed-door room for privacy.

The results of the study will be used to inform teaching practices that can possibly improve student learning experiences in Common Core mathematics, as well as teacher experiences with using iPads for instruction in a mathematics Common Core curriculum.

Individual Interviews
At the beginning of the individual interview, your child will receive a copy of his/her assent form to keep and be will informed that the interview is audio recorded and that s/he is free to stop the interview at any time for a break. Individual Interview questions will include questions on choices that students make when using iPad apps, how students use the iPads, how teachers work with students when using iPads, what students like about using iPads, and what challenges they face when using iPads.

Voluntary Nature of the Study:
If your child chooses to participate in the study, it will be voluntary. Your child's decision on whether or not to be a part of the study will be respected and withdrawal from the study at any point will also be respected.

Compensation:
There is no form of compensation or payment for being part of the study.

Risks and Benefits:
Your child may experience minor risk, such as stress due to observations and the interview. Your child will spend about one hour in the individual interview. He/She will be involved in the study for three weeks. In week one, your child will experience one direct observation while using the apps for mathematics learning. In week two, your child will be interviewed in a closed-door session about his/her experiences with using the apps for learning Common Core mathematics. Some interview questions may be challenging to your child. Your child will not be exposed to any danger by participating in this study

To reduce stress due to discomfort of being observed and interviewed by a stranger, I will do an ice-breaking activity by introducing myself and my role in the school community. In this activity, your child will be informed that I will not be using his/her real name in my writing. Instead, I will assign participants number names, such as Student Number1, Student Number2, and so on. I will reduce the risks of stress that may be caused by challenging questions by simplifying the questions and explaining the questions to your child.

The benefits of this study include the potential to advance the profession of providing education services to students with learning disabilities by showing how iPad apps impact learning experiences in mathematics inclusion classes. The data collected can possibly contribute to informing education stakeholders on inclusion education practices for the Common Core mathematics curriculum.

Privacy:
The identity of your child will be kept confidential within the limits of the law. I will use numbers to identify students and pseudonym initials for teachers to protect their identities.

I will store collected data in a locked cabinet for a period of at least 5 years, as required by the university.

Contacts and Questions:
If you have any questions about the study, you may contact me at sitembiso.ncube@waldenu.edu. For further assistance, please contact the University Research Participant Advocate directly at (612) 312-1210 or by email at IRB@mail.waldenu.edu
Walden University's approval number for this study is _____, and it expires on _____.

Please find an extra copy of this consent form for your records. If you agree to participate, please use the self-addressed, stamped envelope to mail your consent form to me—which should be postmarked no later than (date).

Statement of Consent:
I have read the information and I feel that I completely understand the study to consent to my child's participation. I also understand that participation is voluntary. My signature below signifies that I totally agree with the terms described above.

Parent Name (Print)
Child Name (Print)
Date of Consent.
Parent's/Guardian's Signature
Researcher's Signature

Appendix C: Observational Protocol

Observer's name	
Classroom activity Event #	
Date and time	
Activity participants	Inclusion teachers and students

Student's Activity	**Research Question** What are the experiences of inclusion students using iPads for the Common Core curriculum?	Description of student activity	
		Observed experiences	
		Notes on process and interactions with teachers	
		Description of teacher activity	
General Education Teacher Activity	**Research Question** What are the experiences of inclusion teachers using iPads for the Common Core math curriculum?	Observed experiences	
		Notes on process and interactions with Sped. teacher and with students	
		Description of teacher activity	
Special Ed. Teacher Activity	**Research Question** What are the experiences of inclusion teachers using iPads for the Common Core math curriculum?	Observed experiences	
		Notes on process and interactions with Gen. Ed. teacher and with students	

Appendix D: Teacher Interview Guide

1. How long have you been an inclusion mathematics teacher?
2. What grade and subject do you teach?
3. How many years have you used iPads as an instructional technology?
4. How do you define technology integration?
5. How do you define mathematics inclusion?
6. What is your role as a general education/special education mathematics inclusion teacher?
7. How do you identify students with Math Learning Disabilities?
8. How do you define Common Core Standards?
9. Do all students with learning disabilities use iPads for the same amount of time, in the same way? If not, what are the differences?
10. How do you and/or the students decide how to use iPads?
11. How do you and/or the students decide how much time to use on the iPad?
12. Do you feel that you are able to use iPads to meet individual students' needs? If yes, please explain how. If no, please explain why not.
13. What are the positive aspects to using iPads in a mathematics class with students with Math Learning Disabilities?
14. What are the disadvantages of using iPads?
15. What data do you actually get from reports derived from iPads? How often?
16. How do you use the data for instructional planning?
17. How do you document the use of an iPad in your lesson plans?

18. What are your recommendations for using iPads in an inclusion Common Core mathematics class?

Appendix E: Student Individual Interview Guide

1. How many years have you been using the iPad in school for learning?
2. How many times per week are you using the iPad in your mathematics class?
3. Would you like to increase or decrease the amount of time you are using the iPad in your mathematics class? Please explain your choice?
4. Do all students in your mathematics class use the iPad for the same amount of time, in the same way? If not, what are the differences?
5. Do students decide how to use the iPad in your mathematics class? If yes, please explain how. If no, please explain why not.
6. Do students decide the length of time to use the iPad?
7. How do you use the iPad in your mathematics class?
8. How often does your teacher work with you while you are using the iPad?
9. What do you like about using the iPad in your mathematics class?
10. What challenges do you face using iPads in your mathematics class?
11. What are the ways your teacher could improve the way s/he uses the iPad in your classroom?

Appendix F: Teacher Consent Form

My name is Sitembiso Ncube, and I am conducting this study as a part of my doctoral studies at Walden University. I am currently teaching mathematics in a special day class at a local high school.

You are invited to participate in this study because you are currently teaching an 8th grade math-inclusion class which uses iPads.

Carefully read this form to understand the study before making decisions on being part of the study.

Background Information:
The purpose of this study is to explore the experiences of inclusion teachers and of students with mathematics learning disabilities using iPads in an eighth-grade Common Core mathematics classroom.

Procedures:
If you consent to participate in this study, you will voluntarily take part in a one-hour audio-recorded individual teacher interview at the time of your convenience that does not affect work schedules. During the individual interview scheduled to occur within week one of the study, you will be asked questions about your experiences using iPads in a Common Core mathematics class with students with mathematics learning disabilities. You will also be asked to provide access to three classroom instructional times for lesson observations during the three-week period of study. The instructional times must incorporate iPad-use during instruction on word problems. Finally, you will be asked to provide copies of lesson plans and student work samples for a unit with word problems in which iPads were used.

Interview Questions and Procedures:
You will be given an opportunity to agree on the interview venue. The interview venue will be a secure place for privacy and a place where there will be no interruptions, including noise. At the beginning of the interview, you will get a copy of your consent form, an explanation of the interview procedures. The interview will be recorded on an audio tape. Interview questions will include questions on positive and negative aspects of using iPads, your choices of apps, decisions on assigning apps to students, and your perceptions of students using iPads for mathematics learning. I will send you the transcriptions of the audio recordings to check for accuracy.

Voluntary Nature of the Study:
Participation in this study is voluntary, and your decision regarding participation will be respected. If you decide to participate in the study, you are free to change your mind during the course of the study. You may exit the study at any time with no consequences.

Benefits and Risks of Being in the Study:
There are some risks that can be encountered. One of the risks is using your free time during the one-hour interview. Another minor risk will be having an outsider in your

classroom once a week for a period of three weeks, sharing your lesson plans, and student work samples. There are safety or well-being risks associated with this study.
The findings of this study can possibly assist teachers in effectively using iPad apps or any device with apps to better provide instruction to students with different learning needs in mathematics. Teachers may possibly gain skills for better meeting varying learning styles and preferences of students. At the end of week three, I will schedule a meeting with the principal, teachers, parents/guardians, and student participants to describe the findings of this study. Finally, at this meeting I will thank the participants to exit them from the study.

Payment:

No form of compensation will be given for participating in this study.

Privacy:

Your information will be kept confidential within the limits of the law. I will use pseudonyms to protect identities.
All data will be stored in a locked file cabinet in my home and will be kept for a period of at least 5 years, per university requirements.

Contacts and Questions:

If you have any questions, you may contact me at sitembiso.ncube@waldenu.edu. If you would like to talk about your rights as the participant, you can call the Research Participant Advocate at (612) 312-1210 or email IRB@mail.waldenu.edu.

Walden University's approval number for this study is **_8-22-18-0228204_____**, and it expires on **__08/21/2019_____**.
Please find enclosed an extra copy of this consent form for your records. If you agree to participate, please use the self-addressed, stamped envelope to mail your consent form to me—which should be postmarked no later than (date).

Statement of Consent:

I have carefully read the above information and I understand the study well enough to make a decision about my involvement. By signing below, I understand that I am agreeing to the terms described above.

Printed Name of Teacher Participant
Date of Consent
Participant's Signature
Researcher's Signature

Appendix G: Parent/Guardian Invitation

Dear _____,

My name is Sitembiso Ncube, and I am a doctoral student at Walden University. Also, I have been a special education teacher in the San Bernardino Unified School District for 13 years. As part of my research requirements with a focus on learning, instruction, and innovation, I am conducting a study among eighth-grade inclusion teachers who are currently using iPads with special education students in their Common Core mathematics classes. My study will collect the experiences of these teachers and of their assenting mathematics learning disabilities students who use iPad apps in their mathematics classes.

You are receiving this invitation letter because you have an 8th grade child who meets the criteria of my study. I would like to invite your child to participate in this study.

I am interested in the experiences of inclusion teachers and special education students who are using iPads in eighth-grade Common Core inclusion mathematics classroom settings. To accomplish this purpose, I will observe and interview your child and other assenting students who will be participating in this study. I will describe their experiences and their teachers' experiences with using iPad apps for Common Core mathematics classes. If you give consent for me to collect data from your child—who must also give his/her assent to participate—your child will experience the following. She/he will participate in a three-week-long study, will be observed once in the classroom in each of the three weeks of the study, and will be interviewed individually in the second week. The audio-recorded individual interview questions will include the choices that students make when using iPads, the amount of time they spend on iPads, and the challenges they face with iPad apps. Please find enclosed the parent/guardian consent form that provides the details of the procedures of this study.

If after reading the consent form carefully, you are confident that you understand it and wish to give consent for me to collect data from your child using observations and the individual interview, please sign the parent consent form. Also, please have your child sign the minor assent form if he or she agrees to participate in the study. Please return both forms to me using the stamped envelope provided—which should be postmarked by (date),

Sincerely,
Sitembiso Ncube
Walden University
Ph.D. Doctoral Candidate

Date of Consent Parent's Signature Researcher's Signature

Appendix H: Student Assent Form

Hello _____,

My name is Sitembiso Ncube, and I am doing a research project on the experiences of teachers and students who use iPad apps in a mathematics class. You are invited to take part in the study because you are an eighth-grader in a mathematics inclusion class that uses iPad apps or any device with apps for mathematics learning.

Who I Am:
I am a doctoral student at Walden University, and I will be conducting the research. I have also been a teacher in the San Bernardino Unified School District for 13 years.

About the Project:
If you agree to be in this three-week project, I will do observations in your class and will make notes about how you work with the iPad apps in your mathematics class. I will conduct observations once in each of the three weeks of the study. Also, interactions that you have with your teacher and other participating students will be documented when I make notes.

If you agree to be in this study, your participation in a one-hour audio-recorded individual interview will include my questions about your experiences using the iPad to learn mathematics.

Individual Student Interview Questions:
Some of the individual student interview questions will ask how often you would like to use iPads in your mathematics class, what decisions you make when using iPads, what you like about iPads, and what challenges you face when using iPads.

Voluntary Participation:
You do not have to be a part of this project if you do not want to. This activity is voluntary. Even if you decide to join the project, you can still change your mind later and withdraw from the study at any time. There are no consequences for withdrawing.

Risks and Benefits:
This project might make you tired or stressed, just like completing a long assignment or test. Observations and the interview may make you feel pressured and stressed. Some of the questions may be difficult to answer. But your participation may help improve mathematics learning for students. For example, it may lead to more computer time for learning and to better choices of mathematics apps.

No payment or gifts will be offered for participating in this study.

Privacy:
Your personal information will be kept confidential within the limits of the law. Your name will not appear in the study.

Asking Questions:
If you want to ask questions about this study, you or your parents/guardians can reach me at sitembiso.ncube@waldenu.edu. If you want to talk privately about your rights as a participant, you can call the Research Participant Advocate at (612) 312-1210 or email IRB@mail.waldenu.edu.

I have enclosed an extra copy of this minor assent form for your records. If you agree to participate in this study and have signed the form, please mail it postmarked by (date) in the self-addressed, stamped envelope provided.
Please sign your name below if you want to join this project.

Name of Student
Student's Signature
Date of Assent
Researcher's Signature

Appendix I: Student Invitation Letter

Hello _____.
My name is Sitembiso Ncube, a doctoral student at Walden University. Also, I have been a teacher in a local school district for 13 years. As part of my degree requirements, I am looking for eighth-grade inclusion students who are currently using iPad apps or any other devices with apps in their Common Core mathematics classes. I am inviting you to participate because you are currently an 8th grade special education student using an iPad in an 8th grade inclusion class.

I would like to put together a record of the experiences of inclusion teachers and of special education students with mathematics learning disabilities who use iPad apps in eighth-grade Common Core inclusion mathematics classrooms. As part of my research, I will make observations in your class. The first observation will be in week one, the second observation will be in week two, and the last observation will be in week three. I will interview you and your other participating peers during week two of the study. The data will be used to describe the experiences of teachers and students using apps in a mathematics class.

In the audio-recorded individual interviews, I will ask questions about your choices of apps to use, how often you use the apps, and the difficulties you experienced with using the apps.

Enclosed you will find the student consent form that provides important information about this study. Please read it carefully before signing it, if you decide to do so. If you have any questions about the study, please contact me at sitembiso.ncube@waldenu.edu.

When you feel that you understand the information in this invitation letter and if you decide to participate in the study, please sign the student assent form and return it in the enclosed self-addressed envelope—which should be postmarked by (date).

Sincerely,
Sitembiso Ncube
Walden University
Ph.D. Doctoral Candidate

Appendix J: Letter of Cooperation

August 24, 2018 Research ID: 103-2018

Dear

The attached form is in response to the updated information received by Accountability & Educational Technology on August 23, 2018. All eight criteria have been met and approves your project to conduct research.

A final bound copy or an electronic copy of your study should be provided to

If you have any questions or concerns, you may contact

Sincerely,

Appendix K: IRB Approval

Dear

This email is to notify you that the Institutional Review Board (IRB) has approved your application for the study entitled, "Secondary School Teachers' and Students' Experiences with iPads in Math Inclusion Classes."

Your approval # is 08-22-18-0228204. You will need to reference this number in your dissertation and in any future funding or publication submissions. Also attached to this e-mail are the IRB approved consent forms. Please note, if these are already in an on-line format, you will need to update those consent documents to include the IRB approval number and expiration date.

Your IRB approval expires on August 21, 2019. One month before this expiration date, you will be sent a Continuing Review Form, which must be submitted if you wish to collect data beyond the approval expiration date.

Your IRB approval is contingent upon your adherence to the exact procedures described in the final version of the IRB application document that has been submitted as of this date. This includes maintaining your current status with the university. Your IRB approval is only valid while you are an actively enrolled student at Walden University. If you need to take a leave of absence or are otherwise unable to remain actively enrolled, your IRB approval is suspended. Absolutely NO participant recruitment or data collection may occur while a student is not actively enrolled.

If you need to make any changes to your research staff or procedures, you must obtain IRB approval by submitting the IRB Request for Change in Procedures Form. You will receive confirmation with a status update of the request within 1 week of submitting the change request form and are not permitted to implement changes prior to receiving approval. Please note that Walden University does not accept responsibility or liability for research activities conducted without the IRB's approval, and the University will not accept or grant credit for student work that fails to comply with the policies and procedures related to ethical standards in research.

When you submitted your IRB application, you made a commitment to communicate both discrete adverse events and general problems to the IRB within 1 week of their occurrence/realization. Failure to do so may result in invalidation of data, loss of academic credit, and/or loss of legal protections otherwise available to the researcher.

Both the Adverse Event Reporting form and Request for Change in Procedures form can be obtained at the Documents & FAQs section of the Walden web site:http://academicguides.waldenu.edu/researchcenter/orec

Researchers are expected to keep detailed records of their research activities (i.e., participant log sheets, completed consent forms, etc.) for the same period of time they retain the original data. If, in the future, you require copies of the originally submitted IRB materials, you may request them from Institutional Review Board.

Both students and faculty are invited to provide feedback on this IRB experience at the link below:

Sincerely,

Research Ethics Support Specialist
Office of Research Ethics and Compliance
Walden University