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Teacher Perception of Technology as a Conduit to Acquiring Critical Thinking Skills

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This is to certify that the doctoral dissertation by

Wanda Patrick

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Walden University
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Abstract

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Dissertation Submitted in Partial Fulfillment

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Abstract

Seventh-grade and eighth-grade special education students struggle to learn higher-order thinking skills in pre-algebra and algebra that can be addressed by using technology. However, little is known about science, technology, engineering, and math (STEM) teachers' attitudes toward use of and their actual use of calculators and technology to access students' development of higher-order thinking skills. The purpose of this qualitative case study was to explore the perceptions of rural middle school Grade 7 and 8 STEM teachers in one Western state. This study used Gardner's multiple intelligences and Armstrong's neurodiversity theories as a framework. Participants were 10 Grade 7 and 8 STEM teachers in a Western state. Data sources included interviews, surveys, and teacher journals. Open coding allowed the identification of similar threads, common words, or expressions that were then examined for themes and patterns. The emergent themes included a need for training, teachers' technological expectations, and whether teachers could meet grade level standards and students have success. This study assists social change by informing school administrators and teachers how technology is and is not being used in the classroom and how its use can be facilitated in the future.

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Dedication

This doctoral study is dedicated to my three loving and caring children and their families, Sean Patrick, his wife Jessica and daughter Sonnett, Timeka Patrick-Cardenas, her husband Alex and son Marcus and daughter Arianna, and my son Michael Patrick II. Their love, support, and continual encouragement gave me the strength to reach my academic goal. This dedication includes my mother-in-law, Ernestine Patrick, who gave me the courage and confidence to attempt and completed this monumental task. Then, there is my brother, William Burkett, for his tireless editing skill and having to listen to me ramble on and on about special education, the students, and either their progression or non-progression and what to do next. I am forever grateful to all of my caring and committed family.

Finally, to my late husband, who made me go to my first English class with him, when I thought I wasn't smart enough to go to college. If it were not for him, I would have never known I was able to complete one college course let alone accomplish a doctorate degree.

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The completion of this doctoral study only made possible by the support and encouragement of two very special people. I would like to first express my gratitude to Dr. Barry Birnbaum for his guidance and support throughout this entire doctoral process. He was always there to answer questions, give me support, and to offer encouragement. Dr. Birnbaum went above and beyond what anyone should have needed to do as my chair. He spent many hours advocating on my behalf. Dr. Birnbaum, words are not enough to express how I feel. Thank you to Dr. Keith Higa for coming to my rescue at a time when I felt these were my darkest hours. His guidance as my methodologist and committee member will never be forgotten. His interest in my research and his thought-provoking questions strengthened my study. He was there to support and guide me through the necessary changes and to make sure that this study was academically sound and strong. I could not have completed this study without their continued support and encouragement.

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Chapter 1: Introduction to the Study

Background

A Nation at Risk (1983) painted a dismal picture for U. S. schools. This document contained a call for a standard-based reform and accountability system to be implemented by the federal and state governments and raised expectations for all students. It also contained a recommendation for strengthening high school graduation requirements, while including students with disabilities in general education classes using accommodation or modifications as needed for student success (Vinovskis, 2009, p.16).

Yell and Drasgrow (2009) stated that many things have led up to a law known as No Child Left Behind (NCLB). In 1989, the National Education Summit convened with President George H. W. Bush and governors from all 50 states to address public schools and education. Six goals were developed, which became part of the president's education legislation, America 2000. President Bill Clinton used these same goals as the building blocks for his Goals 2000: Educate America Act. The Goals 2000: Educate America Act created a counsel to approve or reject academic standards.

The Improving America's Schools Act (IASA) was then written in 1994. This act required states to develop challenging academic standards and assessments for all students, while being held accountable for the results. Stecher et. al. (2010), stated what concepts students should learn, what would be assessed, and ensure instructional alignment with the standards was provided in accordance with IASA (p.6). Congress passed the NCLB Act in 2001. President George W. Bush stated that NCLB would be one of his highest priorities. With the passage of this act, only slight changes were needed in those standards, assessments, and accountability already put in place by IASA.

According to Stecher, et. al. (2010), NCLB set ambiguous goals to include that all students should be proficient in reading and math by 2014. This act went beyond the present legislation to judge schools according to student outcomes, to measure the performance of subgroups, to assess teacher qualifications, and to rate school improvement efforts by using research-based practices (2010, p. xiii). NCLB changed requirements for states to have statewide grade-level content standards. Assessments would be given annually to all students in grades 3 through 8 and only once during high school (Stecher, et. al., 2010, p. 4).

Kendall (2011) acknowledged each state was allowed flexibility in setting high standards. The expectations were met by some states but not in others and led to inconsistencies across the 50 states. These inconsistencies put some students at a disadvantage while preparing others for college or careers. National standards have been written for English language arts (ELA) and mathematics. These standards are now known as the Common Core State Standards (CCSS) (pp. 9–10).

Armstrong (2010) confirmed neurodiverse children in the United States have far more opportunities to learn than they did a century ago. He also believed that special education continues to have to improve programs and beliefs about students and their abilities before it merges with regular education but all students with labels are able to learn alongside their non-labeled peers. His perception of the most significant problems in special education that has developed during the past century is that special education is a completely separate system from general education. Special education classes exist for children with special needs in most public schools. Parent advocacy groups that fought for special education services for all students brought this about in the late 1960s. In 1975, the Education of All Handicapped Children Act (PL 94-142) mandated that children with special needs receive an appropriate education in the public school in the least restrictive environment. This least restrictive environment opened the door to special programs for children with learning disabilities. In 1990, Congress reauthorized PL94-142 as the Individual with Disability Education Act (IDEA). This revised act included autism, traumatic brain injuries, and a list of other disabilities eligible for special education services (Armstrong, 2010, p. 182).

Special education has its own training programs, diagnostics tests, special programs, and jargon for discussing about education issues. Often those in education, find it difficult holding a professional conversation with individuals in special education. When students whose parents also have learning disabilities cannot be expected to participate in their child's Individualized Education Plan (IEP) and understand the jargon used during the IEP meeting without an advocate who understands the language helped the parent through the IEP process. Advocates may help these families navigate the IEP process. Although computers and compensatory technology, increased physical accessibility on campuses, and support services for students with disabilities have increased enrollment of students with disabilities in general education classes. Enrollment of students with disabilities has increased in colleges and universities due to pressure to expand recruiting efforts to include students with disabilities. Increased enrollment of students with disabilities and the success of these students would bring word to others to join the success at the campus, which would increase the school's revenue (Leyser, Greenberger, Sharoni, Vogel 2011, p. 163). This requires more teacher communication, more parent involvement, and more IEPs.

Armstrong (2009) stated that special education philosophies are based on deficits, damage, and dysfunctions rather than strengths, talents, and abilities. When examining least restrictive environments the trouble in the general education classroom is often restrictive for all students due to requirements imposed for academic achievement based on performance measured by standardized grade-level assessments. Hessels, Hessels-Schiatter, Bosson, and Balli (2009) and Souza (2011) stated that children with nonspecific learning disabilities as defined in the D*iagnostic and Statistical Manual of Mental Disorders (*DSM 5) (American Psychiatric Association, 2013) have shown a slower rate of learning than their peers in reading, language arts, and math. Souza stated there are several factors that contribute to the difficulty of learning mathematics. This includes associative memory, pattern recognition, and language. These are the three most powerful and useful features in the human brain while trying to learn mathematics (2011, p. 40).

Common Core State Standards

According to Kendall (2011), the goal of the CCSS initiative was to develop a set of shared national standards to ensure that all students in every state are held to the same level of expectations. Students gain knowledge and skills that prepare them for success in postsecondary education and in the global arena. The National Governors Association committed to this work along with advisory groups from Achieve, the National Association of State Boards of Education and the State Higher Education Executive Officers (2011, p. 1). The CCSS are a set of established standards that, if mastered, should provide students with skill and knowledge to advance academically. This includes content and application of knowledge through higher-order thinking skills, internationally benchmarked so all students are prepared for the global economy and society (2011, p. 11).

The mathematical standards are divided into two sets of standards: mathematical practices and mathematical content. The mathematical practices are areas in math students develop and practice from kindergarten through Grade 12. The mathematical content, on the other hand, forms a major part of the CCSS mathematical standards document. The standards describe what each student should be able to understand and accomplish. Clusters, which is a group of related standards, which are a part of a domain that are big ideas that connects the standards and or topics across grade levels (Kendall, 2011, p. 20). The focus for middle school instruction for each grade level should be on students' conceptual understanding of mathematics. This requires students to include proofs of their understanding of probability and statistics and ratio proportions, and to provide viable arguments that validate their understanding (Kendall, 2011, p. 25). Students have not been required to perform this type of understanding using the state standards from NCLB.

Ediger (2011) predicted common core test results will become higher when teachers' pay closer attention to individual learning styles. Mathematics teachers play a vital role in the students' progress in meeting the core standards. The curriculum reflects the optimal achievement in the common core. High standards of achievement for all students, along with attainment of grade level standards, and proficiency on assessments are necessary with or without accommodations (2011, pp. 154 – 155). According to Sousa (2008) to learn and use mathematic knowledge in a variety of ways or settings, the student must have an understanding of the concepts involved and see a concept as relevant (2008, p. 55).

For their annual high stakes assessments, California selected to implement the Smarter Balance Assessment Consortium (SBAC). SBAC includes a required summative exam, which is completed online and uses adaptive testing technology. This assessment is administered during the last 12 weeks of school in Grades 3 through 8 and in high school. Benchmark exams are optional during different parts of the year. These benchmark assessments do not contribute to student's end-of-year annual high stakes assessments final score, but they are designed to provide an understanding of the student's strengths and limitations through an online report. The benchmark assessment will be administered multiple times during the school year so that feedback can be more specific and timely, unlike the state assessments, which are typically not provided until the following school year (Kendall, 2011, pp. 53 – 54). Standards-based education has shown to have both strengths and weaknesses. The focus of common core is to take the strengths of students and seize the opportunity to improve education (Kendall, 2011, p. 56).

According to the California Department of Education, September 10, 2013, the states involved in the SBAC approved the ‘‘Usability, Accessibility, and Accommodation Guidelines”, (http://www.cde.ca.guv/ta/tg/sa/access.asp) which will guide students taking the Smarter Balance summative assessment. This document is available on the California Department of Education (CDE) Smarter Balance (http://www.cde.ca.guv/ta/tg/sa/access.asp). The SBAC is creating a framework of accessibility for all students including English language learner (ELL), students with disabilities, and ELL students with disabilities. This framework is not limited to just those particular groups. SBAC recognizes and understands that each student should have appropriate universal tools (2013, pp.1 – 3).

SBAC is different from assessments that California allowed in the past. California created an alternate assessment: the California Modified Assessment (CMA) for students who qualified to take the alternative assessment according to the student's IEP (http://www.cde.ca.gov/ta/tg/ca/altassessment.asp). The SBAC system provides summative assessments for accountability purposes and optimal intern assessments for local use. Computer adaptive testing technologies are used for the summative and interim assessments to provide feedback data for teachers and administrators. These data help provide information on students and areas that may need remediation or re-teaching. (Smarter Balanced Guidelines, 2013, pp. 6 – 7).

SBAC digitally delivered assessments include a large array of embedded universal tools, which may be used by all students. Embedded tools include an on-screen digital calculator that can be accessed for calculations, embedded rulers, and innovative protractors. These items are available only with specific test questions. When students click on the buttons the tools are made available for that particular test question, which are specific to SBAC specifications (Smarter Balanced Guidelines, 2013, pp. 6 – 7).

Schulte and Stevens (2015) stated that one of the subgroups targeted to meet adequate yearly progress (AYP) are students with disabilities. This particular subgroup has proved to be the most difficult in terms of meeting targeted AYP goals. Many schools have failed to meet mandated state requirements, due to of the low achievements scores obtained by students with disabilities (2015, p. 371). Schulte and Stevens concluded that students identified for special education based on a continual need and special education services were the students farthest behind for grade-level standards and expectations. They often experienced the least amount of growth, during an academic year at grade levels mathematics, and had slower mathematic achievement growth. Progress among students with disabilities may vary based on how consistently the students were served in special education through time (2015, p. 383). Students who are academically successful are more likely to be exited from the special education program than those who are not having difficulty. Achievement gaps between students with disabilities and students without disabilities are smaller when the special education subgroup membership is defined at one point rather than each year (Schulte, Stevens, 2014, p. 2).

Problem Statement

The problem addressed in this study was that seventh-and eighth-grade special education students are struggling to learn higher-order thinking skills in pre-algebra and algebra. The problem is due to their inability to complete multiplication and division algorithm calculations because of a working memory deficit and numerical procedures (Sousa, 2008, p. 182). Students who learn through discovery, prefer concepts instead of routine steps, as well as using the mathematical process and models instead of numbers requiring critical and higher-order thinking skills, which can appear difficult or elusive for some students with special needs (Sousa, 2008, p. 139). Using a calculator helps special education students with calculations allowing them to focus on discovery and finding reasonable solutions for everyday problems, through high-order thinking skills, which also improved understanding of the number system (Bouck, Gauri, Johnson, 2012, p. 370).

Special education students can become anxious, shut down, or exhibit behaviors that manifest and do not allow learning to take place when they are asked to accomplish an assignment they are uncomfortable with or incapable of completing. Generally, the special education students do not transition beyond the automaticity of algorithm calculations into the conceptual understanding of real-world mathematics and conceptual understanding (Sousa, 2008, pp. 119 – 123).

Calculators are a valid accommodation for special education students. Calculator use, in the classroom as an accommodation, depends on the mindset of the teacher (Bouck et al. 2011). The validity of the calculator as an accommodation is not being questioned in this research. Accessing higher-order thinking or critical thinking skills by using a calculator for algorithm calculations, for special education students with memory disorders is difficult. Students have high error rates, while trying to retrieve facts, rely on finger counting because of the demand on the working memory. Using technology reduces demands for working memory which is an essential component for successful skill acquisition (Sousa, 2008, pp. 182 – 183).

This research addressed the mindset of teachers and whether they use technology or calculators in the classroom during learning or assessment of mathematics and science. Although current research addresses pre-service teachers, more needs to be learned from seasoned teachers ensuring that their perception and expertise may be used and taken into account. The research helps fill the gap in the literature in which limited research exists regarding science, technology, engineering, and math (STEM) teachers' perception of using calculators or technology and students accessing higher-order thinking skills. Thompson (2012) stated that pre-service teachers under estimated the potential of students with disabilities and found that the students were often more capable of learning mathematics than expected or realized.

Research addresses different teaching strategies such as problem-based learning, project-based learning, or inquiry-based leaning. The research also addresses using calculators or technology within many of these classes to help educators help students achieve proficiency on the state standards. Problem-based learning according to English and Kitsantas, (2013), Marshall and Horton, (2011), and Tamim and Grant, (2012) supports the development of real-world skills solving complex problems, thinking critically and deeply, analyzing information, working collaboratively learning to communicate effectively, while integrating a range of disciplines. Hakverdi-Can, and Sonmerz, (2012) believed that it was important to integrate technology and technology supported inquiry-based learning which gives students the opportunity to experience scientific modeling while working with data (p. 339). Limited articles were found on teacher reflection or teacher perspective of special education student accessing critical or higher or thinking skills while using the calculator. Walcott and Stickles (2012) stated that research has shown that calculators have no negative effect on the development of the basic mathematical skills but have had a positive effect on the development on problem-solving skills that are at age level.

Purpose of Study

The purpose of this qualitative case study was to explore the perceptions of grades 7 and 8 STEM teachers regarding the use of a calculator or other supportive technology by special education students for basic mathematical calculations as a conduit to learning higher order thinking. Basic calculations that rely on rote memorization of algorithms often prevent the students from accessing their higher-order thinking skills. These skills require elaborate rehearsal to achieve or access their higher-order thinking skills (Sousa, 2008, p. 53). Research addressed pre-service teachers' understanding of mathematics for themselves and how to engage someone else's understands and engagement in mathematics (Meagher et al, 2013), but at this time there appears to be limited research regarding STEM teachers' perspective of using calculators or other technology and students accessing critical thinking skills. This research could provide both general and special education teachers and administrators with useful ideas on how calculator use in classrooms and on assessments leads to critical or higher-order thinking skills.

Research Questions

Question 1: What are the teachers' perceptions of students with working memory deficits using assistive technology during classroom assignments and/or while taking tests to access critical or higher order thinking skills?

Question 2: When working with students who have memory deficits, how are teachers' expectations the same or different when students have technical assistance to access higher-order thinking skills as compared with when students do not have technical assistance?

Conceptual Foundation

The theoretical framework for this study was Howard Gardner's (2006) multiple intelligence learning modalities that originates in human biology and human psychology (2006, p. 6). Also, Armstrong's (2010) concept of neurodiversity will be used in addressing the way we think about neurological disorders and the effect that these disorders can bring change in the classroom while using appropriate accommodations and modifications to assist special education students. According to Armstrong's neurodiversity research, it is never too late to change the brain through alternative learning strategies or innovative technologies (2010, p. 22), and in Armstrong's research, the innovative technology in mathematics was a calculator. Sousa's (2008) found that when a student presents a working memory deficit the brain finds mathematics difficult to understand and learn.

Nature of Study

The phenomenon of interest in my study was to determine whether perceptions of teachers are changed regarding students with memory deficits, when special education students use technology to access higher order thinking skills. Case study design was deemed appropriate in this study to answer such questions by gathering data from a variety of sources. The process of using a variety of sources is referred to as triangulation. Triangulation of data adds to the validity and reliability of the research because it uses several measures to analyze the same phenomenon (Yin, 1994). In this case study, interviews, a journal completed by participants, and a survey was used for the data analysis. The phenomenon of interest must also be bounded within a certain context to define the limits of what was included in the inquiry (Merriam, 1992). In this case, Grade 7 and 8 teachers within a single school were the purposeful sample used. Teachers had the opportunity to explain the effects that the use of a calculator had on students' behavior while they worked with or observed the student during the time in which the student discovered a mathematical concept. Teachers determined whether using the calculator improved critical thinking skills, and further determined whether there were new skills involved or ones that had been previously acquired.

Chapter 3 contains a more detailed discussion of this qualitative case study design.

Definitions

Accommodations: Practical and effective strategies for debt in curriculum for students with learning and behavioral problems while using teachings strategies to facilitate easy applications in the classroom (Valecorsa, deBettencourt, & Zigmond, 2000, p. 194).

Autism: A spectrum disorder of complex brain development, the disorder can be seen to have disturbances in social relationships and communication and repetitive interests and behavior (Armstrong, 2010, p. 56).

California Modified Assessment (CMA): A student needs to make progress in his or her appropriate grade-level instruction. This includes special education and related services that addresses students' individual needs ensuring growth occurs. The IEP team is responsible for ensuring that appropriate high-stakes assessment needs are addressed as part of the IEP process. (http://www.cde.ca.gov/ta/tg/sr/participcrisci.asp).

Common Core State Standards (CCSS): A set of shared national standards ensuring that students in every state are held to the same level of expectation as students in the world's highest performing countries (Kendall, 2011, p.1).

High-stakes assessment: State assessments for State of California assessment system, California Assessment of Student Performance and Progress System (CASPPS) (http://www.cde.ca.gov/ta/tg/sa/documents/suptrecrptjan13.pdf#search=high%20stakes%20assessment&view=FitH&pagemode=none).

Individualized Education Program (IEP): Each student receiving special education services must have a written individualized education program (IEP). This program includes assessment of current educational performance, annual goals and short term instructional objectives, provision of educational services, which includes start and end dates of services, and away to evaluate progress toward goals and objectives (Valecorsa, et. al. 2000, p. 8).

Neurodiversity: originated among individuals with autism spectrum disorder (ASD) who wanted to be seen as different, not disabled. The neurologically different represents a new insight to the neurodiverse support groups for the spectrum disorders (Armstrong, 2010, p. 6).

Modifications: Strategies that allow the students to demonstrate what they know and can do but reduce the targeted skill in some way and lowers the performance expectation, while changing assessment constructs (Valecorsa, et. al., 2000, p. 194).

Assumptions

I made several assumptions while conducting this study. I assumed that the participants would answer truthfully and as completely as possible during the interviews. I expected that the teachers interviewed would have knowledge about technology and calculator used in STEM classes. I assumed that students were familiar with technology use in the science and mathematics classes as well as on assessments. I expected that the interview responses would represent the attitudes, feelings, and mindset of the teacher participants.

Scope and Delimitations

The scope of this study addressed the effects of using a calculator and/or technology, and how using this technology affected the middle school special education students in achieving critical skills.

The first delimitation of this study was that not all teachers and subjects areas were asked to participate; only Grade 7 and 8 science and math teachers were asked to participate. Teachers within the subgroups of ELA, social science, and English language development were not asked to participate, although critical thinking skills were required in their classes. Sixth-grade teachers and students were also be excluded.

Biases

The strong interest in the outcome of this research may lend itself to bias, because I am a special educator and want the best for all students. As a researcher, I needed to keep an open mind and if the research did not lend itself to a positive outcome or directed me into a different direction, I needed to ensure that my personal bias did not skew the objectivity of the established results.

Implications for Social Change

This study was relevant for school administrators, teachers, and anyone interested in ensuring that any student with a disability was provided with an appropriate grade-level education at the middle school level. The results, of the study, provide information to administrators and educators the understanding of how to use a calculator or other technology, allowing students who have difficulty with calculations the ability to perform simple calculations without anxieties and allow educators to focus on teaching higher-order mathematics through scaffolding and universal access. The technology allows students be more accepting of mathematics and more open-minded critical thinkers.

Summary

The purpose of this chapter was to describe the relevance behind using the calculator with special education students in science and mathematics in general and special education classroom to access and achieve critical or higher-order thinking skills. The history of special education, NCLB, teacher qualifications, high-stakes assessments and the struggles of special education students at a rural school in central California were addressed to give an understanding of the issues that surround the topic of using calculators to achieve critical thinking skills.

Sousa (2008) stated that research studies have suggested that only using calculators for non-routine calculations, rather than exploring numbers and concepts in middle school for solving complex problems, has lead students to greater conceptual understanding and higher achievement. Such use helps students perceive calculators as more than simply computational tools. They are allowed to engage in mathematical exploration and problem-solving, which helps them gain the understanding that calculators are tools that can enhance their understanding of mathematics and achieve critical thinking skills. Using calculators in middle school seems to have a positive effect on students' attitudes toward learning mathematics and motivates them to stay on task while helping students achieve significant gains in mathematical achievement and conceptual understanding (2008, p.130).

Armstrong (2010) stated that special education has developed a completely separate system from regular education. Special education has its own training programs, diagnostic tests, instructional programs, and own jargon for discussing education issues.

It also has its own philosophies about how children should be educated based on deficits, and dysfunctions rather than strengths, talents, and abilities (pp. 182 – 183).

In the next chapter, I describe the methodology of this research study. I examine current research that discussed the open and fixed mindset of teacher and how that affects the classroom and student learning. I also address National Council for Teachers of Mathematics (NCTM) stance on using technology as a tool for teaching mathematics. I assessed teacher qualifications, types of classroom instructions, and multiple intelligences. All categories focus on student achieving critical thinking skills through using technology.

Chapter 2: Literature Review

Introduction to the Literature Review

This qualitative study explored the current teaching styles, learning modalities, and technology used within a middle school in central California. It was composed of Grade 7 and 8 special education students who were struggling to learn higher-order thinking skills in pre-algebra and algebra. The special education students' primary challenges were due to working memory disabilities and include the inability to complete multiplication and division algorithm calculations. Learning through discovery and using the mathematical process that requires critical and higher order thinking skills both appear extremely elusive for some special education students. Using a calculator helps special education students with calculations, allowing them to focus on discovery and finding reasonable solutions for everyday problems. This was achieved through using their higher order thinking skills. A need was determined for research to help understand teacher's perspective on how special education students were performing on grade-level standards and common core assessments. These performance tasks required critical and higher-order thinking skills. Research has determined calculators/technology were an appropriate accommodation for classrooms and assessments (Schulte, A. C., Stevens, J. J. 2014,) but there is need to determine what teacher's perspective of this same technology can be used to assist students with calculations leading to mathematical discovery and higher-order thinking skills.

Rosas, C., and Campbell, L (2010), Schulte, A. C., Stevens, J. J. (2015), stated that NCLB mandates that teachers be highly qualified in the content area they teach.

However, this qualification standard has not improved teacher quality for some of the student populations. In addition, teaching positions in mathematics and special education continue to manifest the largest percentage of teacher vacancies. The gap between the highly qualified teacher teaching in general education and the highly qualified intervention specialists teaching in special education continues to grow. Teachers' knowledge of mathematics was one of the most important factors of student achievement. Bouck and Kulkarni, (2009), Watson and Gable, (2013), and Zheng, Flynn, and Swanson (2013), stated that students with learning disabilities struggle with mathematics concepts that range from basic facts to problem solving. These students were behind their peers often performing below grade level in mathematics. Students have a difficult time with counting, and understanding time, temperature, speed, and directions. They also find it difficult to estimate, understand place value, and to compute of basic facts.

The issues of curriculum appear when materials were problem centered and focuses were on conceptual development. This leaves teachers with the challenge of how to teach mathematics to students with learning disabilities while using stated adopted curriculum. U. S. middle school students were falling short mathematically compared with their international counterparts' achievement. Materials specifically designed for students with disabilities were supplemental mathematics resources and middle school math textbooks. These are what teachers use to deliver lessons daily. Textbooks have been found to be the primary vehicle of knowledge acquisition and teachers replacing classroom discussion thus leaving textbooks as the primary source of information in the upper grades (van Garderen, Scheuermann, & Jackson, 2012, p. 2). Students with a math disability may also have other cognitive disabilities that interfere with reading abilities. Limiting instructional strategies to textbook use only adds to challenges students may be faced with and makes learning math difficult for students with and without disabilities.

According to Faulkner, V. N., Crossland, C. L., and Stiff, L. V. (2013), little was known about the elementary teachers' perception of their role in students' placement in mathematic classes in middle school during transition from elementary to middle school. This includes placement of students with identified disabilities. Studies on the teaching of mathematics have a tendency to focus on teaching techniques rather than placement and do not include context, culture, and educational environment as it pertains to student opportunities and performance in mathematics (2013, p. 3). Traditional and standards-based mathematics focuses on computational fluency rather than developing conceptual understanding of problem-solving and higher-order thinking skills. Students with disabilities struggle in both of these areas. Students with learning disabilities were not mastering grade level mathematics content. This may in part be due to their inability to understand the complexity involved with computational skills. If the teacher does not understand the unique learning challenges special needs students have, student anxiety can be affected (Bouck, E. C. & Kulkarni, G. 2009; Watson & Gable, 2013; Zheng, et al. 2013).

According to Watson, S. R. and Gable, R. A. (2013), components of working memory that relate to different math skills have been identified as an area of deficiency among students with math learning deficiencies. If working memory was to improve but other more complex delays in cognitive processes manifest or persist, it is likely that the mathematics disability will continue. Delays in cognitive processing can end up here with mathematics problem solving. Students with learning difficulties were consistently challenged with the skills needed to successfully solve mathematics word problems and mathematical calculations needed to be successful (Wilson, 2013, p. 2). These mathematic difficulties will continue to have negative implications for students with learning disabilities in terms of future success in mathematics.

The National Council for Teachers of Mathematics (NCTM), standards advocates the use of calculators in teaching and learning of mathematics within the standards-based curriculum. This tool is now encouraged to be included as an intervention option, whereas many of the traditional programs do not advocate its use. Common Core Standards include a technology strand that supports calculator use and included such use in high stakes assessments that have in turn brought their own challenges into classroom learning and assessments. Teachers of students with disabilities need to share experiences, curricular materials, and data collected while using assistive technology during classroom instruction and during assessments (Bouck & Kulkarni, 2009; Brown, 2010; Cho & Kinston; 2011). Walcott and Stickles (2012), stated that research has shown that calculators have no negative effect on the development of the basic mathematical skills but have had a positive effect on the development on problem-solving skills that are at age level. In addition, the use of calculators by students had positive outcomes when allowed to be used while taking standardized test. The conflict between traditional instruction and hard data advocating the use of assistive technology continues to be the dilemma for all special educators, who struggle to ensure each special needs student achieve at their highest level.

According to Pyke, A., and Lefevre, J. (2011), students have difficulty solving addition problems using counting algorithms. The cognitive process that supports the domain that affects recall attempts, mental computations, or student's acquisition of arithmetic facts may be appropriately supported by the use of a calculator. It was thought that answers from the working memory increase the number of exposures to the information. However, the nature of learning the task may also influence how successful the student may be able to recall or subsequently recall information. If recall fails and the confidence in retrieving an answer is low, then the student may start to use such things as counting. Recall is going to be more difficult when trying to retrieve facts from a special needs student whose working memory is not fully functional, when the working memory is the deficit. The computation process may strengthen the retrieval pathway to the answer as a byproduct of the algorithm if it is facilitated by the use of calculators, according to Pyke and Lefevre (2011). According to Watson and Gable (2013), students with mathematics disabilities, dyscalculia, math learning disabilities of the working memory, also show evidence that basic academic skills are lacking. The achievement gap between students with and without math difficulties is significant (2013, p. 1). The benefit from using a calculator is that there is a likelihood of recall from seeing the correct answer and the number of uses of the calculator without the added pressure of recall. Despite repeated exposure to the mathematical process and algorithms the use of a calculator will extend needed computational time.

The availability of calculators and other assistive technology allows teachers to consider and reflect on the mathematics that they are teaching, contingent on student success. The decision teachers need to make is which skills are essential for students to master, and which is more effective, traditional memorization or using technology to complete calculations to solve mathematics problem. Teachers could also use calculators while helping students prepare for classroom and assessments. When calculators were not permitted on high-stakes assessments, teachers were reluctant to use calculators and technology in the classroom, but when calculators were permitted on assessments, teachers needed to be using calculators in the classroom to help students prepare for assessment. Calculators could play an effective role in scaffolding, which could compensate for weaknesses in lower level skills and help with calculations while acquiring higher-level skills. The instructional focus would move from teacher directed instruction to the student center task that would extend beyond the classroom and involved authentic problem-solving and include higher level thinking skills (Asli, 2010; Ozgun-Koca, 2010; Meagher, Edwards, & Ozgun-Koca, 2013; Polly, 2009). Historically educators were concerned that the calculator would carry out the complex calculation procedures in a way that students would not understand. However, students who had difficulties with algorithms, traditional paper and pencil work may continue to have these difficulties while trying to accomplish grade level curriculum. The student’s anxiety level may become less with the use of technology.

Technology offers the potential for not only enhancing learning but also for teaching mathematical skills to all learning levels of students. Students can enhance the spatial visualization skills while trying to achieve richer context and a greater understanding in mathematics. Because of educational policies and the strong correlation between teacher beliefs and teacher practices, technology is still used marginally in classrooms and instructional support is insufficient with varied impact on student learning (Handal, Cavanagh, Wood, & Petoca, 2011; Song & Looi, 2012). King and Robinson (2012), reported the intended use of calculators was to aid students in the performance of repetitive computational processes and free them to focus on other challenges, which allow them to predict and understand required concepts (2012, p. 1). Song and Looi (2012), stated that the correlation between beliefs and how learning happens and student understanding are influenced by the specific practices in the classroom. These practices also apply to the teachers who believe technology can be used to enhancing student learning or eliminate any previous misconceived ideas, as to how the tool can be used to facilitate student learning. The beliefs of the classroom teacher are the driving force as to whether technology is a part of the learning within that teacher's classroom. Using technology can relieve students from focusing on procedures and allow them to develop and discover problem-solving strategies. This enables students to discover more complex mathematical and algebraic topics without the anxiety of not knowing an algorithm or mathematical facts.

CCSS outline the need for students to make discoveries and justifications, and that calculators and technology be provide in an environment in which students observe and discover patterns in data without fear of not being able to complete any or all calculations. Reaching standards require an effective curriculum, research, and classroom practices that connect with the abilities, interests, and understanding of students. These things help not only by promoting student learning but also develop technologically-rich interests and discovery while creating a supportive and learning environment (Main, 2012; Rix & Paige-Smith, 2011).

Graphing calculators are expected to be used in seventh grade classes as opposed to the standard four function calculator so that the visual display of problems and prompt feedback on errors while entering information is available. The teacher sets up a problem for the student to investigate. The teacher also provides the resources, but they do not provide the students with an expected outcome. The students set up the problem, plan procedures and work out the solution while developing conceptual understanding using mathematical concepts and algorithms. The teachers' role will shift from telling student the answers to facilitating students' inquiry activities. It's important to understand how students work collaboratively to make sense of problem and come up with a solution (Bouck, 2009; Song & Looi, 2012). Fisher, Bailey, and Willner (2012) stated visual calculators increased the consistency and performance while decreasing impulsive responses. This increased the information learned and students' participation in the discussion and justification of answers (2012, p. 588). This discovery process helps students develop and lead to new ways of completing pre-algebra and algebra concepts.

Asli (2010) affirmed that teachers did not believe that calculators would benefit pre-algebra and algebra instruction. This was before a demonstration of possible uses was made. After that brief experience, some of the participants reconsidered their beliefs and approved the technology as a tool to create effective teaching environment, while guiding students in a possible different direction without telling the student how to solve the problem but by letting them discover the mathematical concepts (2010, p. 60). The teacher's concern was determining what the students were to learn verses following mathematical procedures. It was noted that students became more active in the learning process and exchanged information within their group. It was also noted that tools could be used in teaching pre-algebra and algebra. Teachers scaffold lessons, using the universal access available provided by the publishers, helped students comprehend concepts. Technology can be used in the role of helping construct a deeper conceptual understanding of math topics, encourage knowledge sharing among all students (Asli, 2010; Bouck & Kulkarni 2009; Bouck et al., 2013), while relieving special-needs students of the need for memorizing algorithm mathematics. Technology does not always guarantee student success in mathematics, however it does enable students to acquire and understanding some new concepts quickly and easily (Hitt, 2011, p. 724).

Along with appropriate technology, teachers with positive attitudes toward students with special needs are more involved with the students, promoting higher-order interaction with these questions and statements that engage problem-solving, reasoning, and prior knowledge use which requires pupils to think, rather than just check for understanding. Faulkner, et al. (2013), argued that students with an IEP and teacher's perception of the students’ ability may not match students’ performance. Teacher perception and IEP are predictors of the student's placement in a math class. Student's math performance found to be twice as powerful of the predictor of the math placement as a teacher's perception and student receiving special education services. On the other hand, the math performance and the teacher perception could carry virtually the same weight in math predictors if teacher perception was not automatically low due to student receiving services. Students may be gifted and receive special education services and because of stereotyped understanding of students with IEP's and services under the special education placement teachers may have a perception of students' ability. These expectations may lead to placement and expectations that may not be accurate or appropriate (2013, p. 10). Changing the mindset of the teacher to include technology while teaching mathematics, pre-algebra, and algebra could also make a change in the student's mindset of learning pre-algebra and algebra while understanding how to utilize mathematics in real-world scenarios.

Bouck, 2009; Handal, Cavanagh; Wood, Petoca, 2011; Hitt, 2011; Bouck et al, 2013, have confirmed that using calculators for students with and without disabilities positive results. They proposed that graphing calculators allow students to develop a conceptual understanding to research and connect algebraic and graphical representations to their data at their skill level and problem solve; this can in turn, improve high-stakes and classroom test scores, due to student's involvement and improvement in mathematics. This leads to the possibility of the student developing conceptual understanding and problem solving through discovery. While using the graphing calculator, students answered more problems correctly then students did prior to having access to the calculator and used pencil paper method. Students with disabilities who had access to a graphing calculator increased the number correct on a post assessment indicating that access to the calculator did result in higher assessment scores for the sub group of students with disabilities. The research suggests that the calculator assisted students with disabilities in correctly solving mathematical problems.

Brown, (2010); Ozgun-Koca, (2010), Schulte and Stevens (2015), stated that the calculator provided for possible solutions the students could access by automating mathematical operations that were tested in a pen and pencil environment. Access to the calculator would encourage students to attempt more problems leading to discovery and accessing higher order thinking skills. The calculator would alleviate having to recall basic math facts but it would not remove the difficulty of solving word problems. Students with disabilities were able to demonstrate the problem-solving ability to a greater extent when a calculator was used, which helped to overcome the student's challenges with basic math facts, rote procedures, and mental math (Bouck, 2009; Ozgun-Koca, 2010; Bouck et al, 2013). There was a suggestion that calculators alone would not diminish students' difficulty with understanding what the problem was asking, but according to Ozgun-Koca, (2010), Schulte and Stevens (2015), the calculator would allow students to focus on concept development and problem-solving strategies and the calculator would allow teachers to refocus their instruction on pattern recognition instead of memorization.

Bouck and Kulkarni (2009), Schulte and Stevens (2015) stated that the lack of instruction on how to use calculators was indicated by students with special needs not knowing and understanding how and when to use the calculator. The researchers you stated teachers need to use direct instruction to teach the students how to use the calculator to support the learning. Students need to learn what problems are asking them to do, decide how to solve the problem, and then put the information into the calculator to do the computation. This needs to be taught consistently within the classroom. Also students need to have the calculator provided by the school rather than assuming students will supply their own. Students need to be given the time to learn and discover how and when to use calculators. Calculators can assist students with disabilities to solve problems that they might otherwise not be able to complete, encouraging discovery, and encouraging higher-order thinking skills.

Brown (2010), Schulte and Stevens (2015) stated that the use a calculator required the questions and answers wording on assessments needed changing. The type of skills practiced and assessed go beyond actual recall, the students need to use other methods to solve a given problems. These problems require students to present and justify conceptual knowledge in a new and different way. Students are required to transform mathematical information from one form to another, such as algebraic to graphs and modeling real-life situations providing proof that the student understood and can justify their conclusion. The calculator has an impact on questions asked for calculations or algorithms but if a calculator is used to provide alternate solutions on comprehension test where the key requirement would be to enter information into the calculator and interpret given information. Classroom instruction and assessment would provide questions that require students to move between different types of information that students can apply to the problems in real-world situations. The change of introducing calculators will not change the mathematical skills assessed on high stakes assessments but will include the need for interpretation, justification, and higher-order thinking skills.

According to Calculator and Black (2009), success for special needs students requires collaboration between general and special educators, a plan to include how and what to teach along with a discussion on challenging behaviors, a way to assess and report students’ progress, and family involvement. Administration enables and encourages the planning and evaluates that all instruction and learning optimizes all students' abilities. The goal is to ensure all students participate in activities and assessments in all general education or special educational classrooms and that curriculum is appropriate and accommodated as needed according to each special education student's needs and IEP (2009, p. 330). Schulte and Stevens (2015) stated it is important that each educator understands the significance of the student having access to grade-level curriculum and how the student will benefit from instruction. General education teachers need time to collaborate with special education case manager to address the requirements of the students IEP goals. Calculator and Black (2009), Schulte and Stevens (2015), confirmed there is a push for all students to have access to the general education curriculum and to hold teachers accountable for demonstrating and guiding students' attainment of the general education goals and objectives. Efforts are made to align special education and general education curriculum to ensure grade level goals are achieved moving toward all students to be included in grade level high stakes assessments.

Cho and Kingston (2011) stated that failure to provide appropriate instructions to students with disabilities jeopardizes their academic achievement (p. 8). Student success can only be accomplished if students use appropriate accommodations or modifications in the classroom while learning and accessing grade level curriculum. Kapur and Rummel (2012) stated the goal was to activate prior knowledge which would initiate learning so that the student could either relearn a concept or learn new material. Tasks will be designed with the assumption that students could activate thinking about concepts even if they had not formally learned it yet or role-play support for students in action (2012, p. 649). Educators are expected to provide support and direct instruction as needed keeping students on target without providing content knowledge allowing students for productive failure and growth. Productive failure is where a student persists to solve a task and no other support is provided. The teacher compares and contrasts the student solutions. The student comes up with a solution that is compared to the Think Ask Understand (TAU) and through that there are no direct instructions, only students collaborate to achieve their results of the task. The students' acquired result increased their learning. The issue is not whether to provide support but rather when and where to provide the support (2012, p. 647). If a student can describe and discuss the task with a peer using academic vocabulary, then both students come out ahead. They can successfully understanding and critically think about what is required to complete the task.

Mindset

According to Dr. Dweck (2008) a mindset shows the power of person's beliefs. These beliefs strongly affect what an individual wants and whether they succeed in getting it. Changing an individual's beliefs can be profound and guide an individual's life. Much of what an individual may think as a personality trait actually grows out of an individual's mindset and can prevent individuals from fulfilling their potential (p. 1). Dweck believed everyone is born with a drive to learn. What could inhibit an individual's learning is a fixed mindset. A fixed mindset suggests fixed traits. Students with a fixed mindset want to make sure they succeed and don't stretch themselves. They believe their intelligence was a fixed trait not something they could develop. Whereas, a growth mindset is one that believes they can grow and get smarter because it is a choice. These students stretched themselves due to wanting to become smarter by digging in and doing what it takes (pp. 16 – 17).

The fixed mindset not only holds true for students but also educators. Asli (2010) stated that participants in the study had no idea on how or when they would use calculators to teach pre-algebra/algebra without pencil and paper. They stated it would not be useful to use calculator in instruction. They expected students to follow procedures and to get somewhere, if a calculator was going to do that for the student what was the student to do? They felt calculators would lead them to lose their manipulation skills and make them lazy (2010, p. 60). Bouck and Kulkarni (2009); and Bouck et al, (2013) stated teachers of traditional curriculum reported lower levels of acceptance of calculator use in the classroom even though the incorporation of calculators in daily classroom activities suggests that using calculators result in students increased participation and discovery. This is an example of a fixed mindset: Not considering that technology could possibly enhance or assist in achieving higher-level thinking skills with the availability of this technology. Whereas on the other hand, an individual with growth mindset would look at ways to use calculators and technology to compensate for weaknesses in the lower skilled students while also trying to acquire higher level thinking skills and participation.

Dweck (2008) declared that everyone learns differently and challenged educators to try and find the way that works best for special needs students with learning disabilities. She suggests that to try to find a way to impart information and get students involved in the learning is not sheer effort on their part but finding the right strategy (2008, p. 178). Asli (2010) and Brown (2010) argued that shifting from paper and pencil environments and repetitive techniques to calculations as well as calculator use in assessments require educators to implement usage in the classroom. The researchers concluded that there is a need to do less testing of algorithm skills when calculators make the skills obsolete. Teachers can concentrate on interpretive skills that could be used on solving world scenarios. The traditional paper pencil work that special needs students continue to be required to overcome are inhibiting learning, because of their lack of calculation skills.

Handal, Cavanagh, Wood, and Petoca (2011); Vreman-de Olde, de Jong, and Gijlers, (2013) affirmed that implementation of educational technology in school depends upon teacher supporting the technology and opinion that supporting teachers believes in regards to the new technology are important as curriculum resources and professional development. If the teachers believe in the change it is likely to happen but if the teachers resent the change then the subsequent change and reform will be long and complex. If the technology seemed to assist students in investigation, as well as reflection on what should be achieved during the lesson. Using technology to assist and investigate, while accomplishing mathematical calculations; students formulate an explanation for the viability of their answer using the data as it relates to how each student's investigation and use of technology helped to emphasize the importance of technology in today's mathematical curriculum.

The accommodation of the calculator, according to Bouck and Yadav (2008), and Engelhard, G., Fincher, M., and Domaleski, C. S. (2011), has been examined to determine the validity of the accommodation for students with disabilities on assessments. Inconsistent results have been found when examining the use of calculators as an accommodation for students with learning disabilities on assessments. This research is not determining the validity of whether a calculator is a valid accommodation.

Teacher Preparation

According to Dray and Wisneski (2011) educators that work with a diverse student population may find it difficult due to the fact that students may come from backgrounds that are unfamiliar to the educator. Teacher educators need to notice that issues can arise when a teacher or teacher of educators attempt to make meaning of behaviors in the classroom, behaviors that concerns student statements, class management or discipline of students when there is a cultural difference involved. Educators may not be aware of how diversity affects within the classroom and the way they should or could interact with the students (2011, p. 1).

Moorehead and Grillo (2013) stated in STEM inclusion classrooms general education teachers often have limited experiences with the professional development paradigm to teach diverse groups of students including those with special needs. They felt it would be logical and practical to add special education teacher to the classroom to meet the students' diverse learning needs, which would theoretically increase the achievement of all students. The ultimate goal would be the bringing of two educators into one classroom to set up a unique skill set of co-teaching relationship (2013, p. 1).

Thompson (2012) stated general education teachers have mixed-views for inclusion and often do not feel they are prepared to teach students with disabilities. General education teachers believe that the special education students have the right to be educated in the general education classroom but they themselves lack the training necessary to make inclusion successful in that they require more professional development to be successful teaching students with disabilities (2012, pp. 53-54). Teacher sensitivity requires that teachers look inward on their personal assumptions and biases. This ensures that their beliefs cannot affect how they treat students. Teachers should experiment with responding differently to students, while noting what happened, reflect on how students respond, and how they felt about the teacher. With this reflection, the teacher needs to ensure there are no records of this reflection and no retaliation against a certain student. Then, the teacher can consider alternate approaches. This process can help teachers develop a deeper understanding of students' behavior while understanding the biases that may be helping to create an unsettled classroom. This will let children be children and understand that the behaviors do not define them, while also allowing the teacher to have different behavior expectations for different children (Dray & Wisneski, 2011; Moorewood & Condo, 2012).

Pecore (2013) stated the difference between beliefs and practices that teachers should understand and strategies to implement that encourage reform that increase student performance on high-stakes assessments to also increase student gains and cognition, and development of skills, independent learning, cooperation, and motivation requires meaningful and ongoing professional development with follow up. The fixed mindset of the teacher may lead them to believe that the students fail because of student's own deficiencies or that handsome family and not value education. These teachers may not understand the student's failures are attributed to the student's lack of ability or family dysfunction. Teachers need to communicate with students understanding student diversity and remembering personal bias.

Marshall and Horton (2011) acknowledged that teachers need to be equipped to facilitate the conversations to help students analyze the information that they are gathering instead of recalling, defining, or formulating a list. Mathematics needs the conceptual knowledge over surface rote learning. Teachers no longer need to dominate by lectures where they pour knowledge into the student. Students need more thoughtful interaction while allowing students to successfully and meaningful investigation an inquiry (2011, p 2). Leyser, et al.(2011) confirmed the willingness of teachers to respond to students that required accommodations and also spend more time assisting them if they had the necessary knowledge or skills to make the accommodations.

Thompson (2012), Hinton, et al, (2015) commented that pre-service teachers stated that the potential of students with disabilities are often more capable of learning mathematics that they, the teacher, expected or realized. Students with disabilities benefited from using calculators and manipulatives are often more capable of learning mathematics than previously realized. Pre-service teachers found that many of the same strategies could be used to teach their neurotypical classmates. Many of the teachers reported they do not have such knowledge and have never been provided with professional training to obtain the knowledge on how to address and assist the students that require support. These participants made no reference to written work; they discussed using manipulatives and pictures to represent or bring more meaning to mathematical concepts. Educators are willing to provide the variety of instruction required to accommodate students but are ill-prepared.

Instruction

Cho, Bottage, Cohen, and Kim (2011) stated teachers that apply an overarching problem presented in a multimedia format where students work in small groups that share common core characteristics with problem-based learning require students to work together to develop solutions to the problem. According to Sockalingam and Schmidt (2011) problem-based learning designs and principles indicate that the problem should: 1) simulate real-life, 2) lead to elaboration, 3) encourage integration of knowledge, 4) encourage self-directed learning, 5) fit in with students prior knowledge, 6) interest the students, 7) reflect the faculty's objectives (2011, p. 8). This requires teachers to provide skill instruction as needed. Learning how and when to scaffold problems provide students with multiple opportunities to practice their skills in varying context. Problem-based type of instruction supports teaching, learning, and assessment.

Tamim and Grant (2012) stated that teaching skills beyond the content, while making learning more personalized and more varied is all part of the student learning experience. Teachers need to promote an environment of inquiry and challenge which creates an intrinsic value of learning. Moorehead and Grillo (2013) also stated students who benefit from concrete materials for abstract concepts by placing them in small groups that support their academic weaknesses help minimize the frustration and often reduce behavior problems. Encourage students to take learning risks, while defending or justifying their answers providing development of the cognitive process towards higher order thinking leaving teachers to facilitate and coach. This will also give students, according to Cole and Washburn-Moses (2010) time for conceptual understanding rather than the time to memorize facts and apply algorithms. Lower-level commands consist of memorization and procedure such as using algorithms without required the understanding an explanation of the underlying concepts is a higher level demand which includes procedures with connection to the task. Understanding underlying concepts and encouraging students to represent ideas in multiple representations while to the mathematical tasks are very difficult in different for a special education student and teacher (2010, pp. 15 – 16). This type or style of common core instruction improves the effort or effect of teaching and provides students a way to solve complex problems with appropriate instruction and accommodations. Students can transition from class to class or environment to environment improving mathematical understanding.

Burton (2010) suggests using daily data, graphs, or charts. The use of T-charts, single and double Venn, and bar graphs are a way to present data. Initially data can be gathered for birthdays, siblings, and pets. Then, the information from the presented dot plots, bar graphs and histograms. Students can learn to understand what the data represents and how to represent it in multiple ways, once the data is collected. Students can discuss their observation of the data using mathematical vocabulary; what can be learned from the data, and how the data can be represented in numerical equations, ratios (parts to whole), or fractions (part to part). Getting students to communicate or discuss things that are important to or about them can ensure students engagement in data analysis (2010, p. 92). According to van Garderen, et al. (2013), a diagram used to process an activity for solving a mathematical problem or a known representation used to analyze problems or solutions, justify or explain actions, predict consequences, evaluating progress, or justify results could be a powerful tool when used to solve word problem while unpacking complex or abstract concepts (2013, p. 2). These tasks can be accomplished or discussed with varying degrees of difficulty depending on the students' grade level and cognitive abilities but any representation can only be useful to the extent that the student can understand the representation.

Burton (2010) included in the discussion for number sense, that the teacher include a number for the day. This number could be expressed in a multitude of ways. It could be represented by pictures, words, tally marks, digits, or equations. Students can explore the relationship between numbers, also using positive and negative integers. This lets students become aware that there is no one right way to express a number and it gives students the flexibility to learn and make sense of numbers in a way that suits them

(2010, p. 93). This is also the time students can learn from their peers and teams work through problems and discuss how to make sense of numbers.

Problem Based Learning (PBL) according to Kamp, et al. (2012) "is an instructional method originating from the active learning perspective, allocating responsibility of learning on the learner where people learn by giving meaning to experiences and interactions with others"(2012, p. 386). Problem-based learning according to (English and Kitsantas, 2013; Marshall and Horton, 2011; Tamim and Grant, 2012) supports the development of real-world skills solving complex problems, thinking critically and deeply, analyzing information, working collaboratively learning to communicate effectively, while integrating a range of disciplines. Students became responsible for their learning while actively participating in making meaning of knowledge. Students must make the shift to active learners and behaviorally active in the learning process. Teachers must be intentional and direct with the learning environment and with support strategies for transition to the role of active and engaged facilitators (English & Kitsantas, 2013, p. 130). Students in a problem-based or inquiry learning environment are expected to approach learning in a scientific way and obtain knowledge through discovery while collecting data to evaluate with peers and obtain a valid conclusion which they can justify (Gijlers, Saab, De Jong, Van Joolingen, & Van Hout-Wolfers, 2009).

Marshall and Horton, 2011; and Pecore, 2013 presented in their research, that there was a positive correlation between the amounts of time spent exploring concepts and cognitive levels of students. The alternative was the negative correlation with the amount of time spent by a teacher explaining concepts and lower cognitive levels of some students. Teachers can guide students in the inquiry-learning and problem-based discovery and the learning process but ultimately it needs to be the student's learning environment that determines ultimate success.

During problem-based learning, students learn to construct knowledge and make meaning through a process of questioning, sharing, and reflection. Students work together in groups to conduct the research and share solutions to complex problems. The teachers are to stimulate, motivate, and encourage reflection that facilitates learning through scaffolding, feedback, and using prompts for thinking. The teachers who utilize such targeted practices have roles that are considerably different from those who use a conventional curriculum. These teachers may be called tutors or facilitators as they actively engage students in the learning process. While facilitating the students learning process, teachers encourage stimulating discussions among the team members, by raising thought-provoking questions, encouraging collaboration, and providing feedback at appropriate times. It is the student who takes the responsibility to synthesize the content itself and directs the learning of the group discussion to determine the nature of the problem (English & Kitsantas, 2013; Stockalingam & Schmidt, 2011). Students with disabilities are able to discuss the approach to solve a scenario. They use internal resources in order to manage situations, engaging in discussion that could improve appropriate outcomes. Students rarely are able to supply more than a single outcome to justify their decision (Fisher, Bailey, & Willner, 2012, p. 589). When teachers observe student struggling with the learning process, it is an indicator that students need support and teachers need to provide the support and cultivating behaviors and strategies to lead the student in the learning process. Students will be at different levels of ability but will improve in the proper environment and with the use of scaffolding. Students will make mistakes as they learn and as more challenging topics occur.

Hakverdi-Can, and Sonmerz, D. (2012) believed it was important to integrate technology and technology supported inquiry-based learning which gives students the opportunity to experience scientific modeling while working with data (2012, p. 339). Technology can provide a different approach and overcoming the issues in teaching, school culture, and teacher and student constraints. Attention has been drawn to this use of technology in education especially when supporting inquiry-based learning. According to Ruthven, Deaney, and Hennessy (2009) graphing calculators were primarily used to generate patterns of graphic images by students themselves through discovery which saved time, enhanced student motivation, and allowed for more examples to be generated (2009, p. 282). This gives students the opportunity of experimenting and participating in scientific modeling, achieving significantly higher learning outcomes than those used in the traditional textbook approach.

Technology Supported Inquiry Learning (TSIL) maybe an alternate approach that integrates computers into the educational curriculum. Teachers need to develop an understanding of the fundamentals of TSIL as well as demonstrate the ability to transfer the understanding into practical applications to ensure students are involved in discovery and learning (Hakverdi-Can & Sonmerz, 2012, p. 339). Ozgun-Koca, (2010) stated many teachers cannot imagine how to use technology in their classroom and only know how to use paper and pencil for instruction because that is how mathematics has always been taught. Mathematical instruction is in need of an update. Teachers' lack of experience and understanding of technology can be a hindrance to the learning process. Students must also be motivated to learn with technology and not be distracted by its use.

Ediger (2011) stated that math teachers must expect reasonably high standards of achievement for pupils. Learners need to feel that mathematics is worthwhile so that they will put forth the effort not only to achieve at their best level, but obtain objectives. The common core objectives and assessments mandate teachers align their subject matter with purpose. Pupils may need help from the teacher as well from peers to make sense of instruction and to work toward the common core goals. The collaborative environment must be a part of the pupil's everyday learning to ensure that confidence and trust are being maintained (2011, p. 154). Gijlers, et al. (2009) stated that collaboration can improve not only the quality of the learning process but also the learning outcomes. These researchers believe inquiry learning and collaborative learning are a natural way to scaffold instruction due to the fact that students must make decisions and choices which offer the opportunity for discussion. Students, while working on problems, collaborate and argue with peers until a consensus has been reached (2009, p. 253). Wilson (2013) stated that guiding students who struggle with mathematics through a process of solving mathematical word problems or mastering the complexity of the word problems can be slow. However, through scaffolding the lesson so that the student can learn at a steady pace, a process can be had that leads to student success. The need for successful instruction strategies that not only help students who struggle but also raise student involvement and motivation in learning is imperative (2013, p. 8). Students' effort and natural ability are what can make common core successful.

Teachers need to have high yet reasonable expectations to ensure the learning process of mathematics is achieved. Scaffolding can be a part of students' ability to obtain this high level of expectations. Math teachers need to be aware of students' present levels to ensure they are able to scaffold and obtain optimal achievement. The need is to focus on the child’s present mathematical level and obtain higher-level thinking in mathematics through scaffolding. Students need to experience success in learning, while using diverse styles of instruction and learning modalities. Teachers must have a positive attitude toward curriculum and content to ensure the learning experience is achievable (Ediger, 2011, p.156). Scaffolding limits the student to focusing to the task at hand, while redirecting the temptation to become off task. According to Monchai and Sanit (2013) "there are five different scaffolding techniques: 1) modeling desired behaviors, 2) offering explanations, 3) let students participate, 4) verify and clarify students’ understanding, 5) invite students to contribute clues"(p. 48). These scaffolding techniques can be integrated at any point depending upon material being taught. The goal of scaffolding is to offer just enough assistance to the student so that they feel assured enough to be able to recognize concepts and problem solve. Technology has changed education. Teachers have had to adjust teaching methods in response to the technology over the years; putting technology in the classroom will not automatically make the difference. The adjustment goes beyond teaching mathematics. Appropriate staff must be provided, (Monchai, Sanit, 2013; Kapur, 2010; Ruthven, Deaney, &

Hennessy, 2009). Students continue to have difficulties learning and teachers have to prepare the students with the skills necessary to problem solve.

Teachers need to instruct students on how to listen to each other, and ask for clarification when they do not understand either the teacher or their peers. Equally valuable is the ability to understand and respect each other's ideas while students contribute to the process of learning (Gijlers, et al., 2009, p. 264). Students can act on strategies and use them effectively; depending on which strategies they have available to them and when to apply such strategies. When teachers and students overestimate the students' abilities, adverse behaviors begin and adjustment needs to be made so that the student can become more autonomous in their learning. Becoming more active learners and showing progress in their academic results (Hessels, et al., 2009, pp. 183 – 198) is also important. These procedures will produce a large amount of communication between students and facilitation by the classroom teacher.

Marshall and Horton (2011) stated in order for students to get ahead and be a part of tomorrow's world they must be able to solve more complex problems instead of just memorizing algorithms, formulas, and definitions. They feel that the nation's classrooms are not successful in helping the students be critical thinkers and problem solvers (2011, p. 2). This also means that students with disabilities need to use the accommodations provided for them in their IEP. According to Leyser, et al., (2011) some educators worry about the fairness of the accommodations for students with disabilities as compared to those without disabilities. They are uncertain as to whether they are being fair to all students. There is concern whether the grade point average of the student using accommodations is accurate. The idea of the assignment which uses extra time to complete with the assistive technology is not supported, but they are willing for the student to demonstrate competency in other ways which does not change the construct. The negative attitude of the teacher towards accommodations impacts the education of the special needs student, as long as the teacher stays committed to the fixed mindset and is unwilling to grow.

All students need know how to develop statistical literacy by the time they become adults. Students' statistical education must begin in elementary school according to Mathews, Reed and Angel, (2013). Statistical problem solving has all students involved in the data collection, analysis, investigation and interpretation to achieve results (2013, p. 27). All students who enter high school and from middle school should be able to identify and use tables and graphs, and those students that graduate from high school should be able to determine if the data is presented accurately. Also, they need to be able to find other data, present, and justify their analysis (Mathews, Reed, and Angel, 2013, p. 31). Although this is asking a great deal of the special needs students, this is not an impossible request.

Not all educators are in favor of problem-based learning. Woo and Laxman (2013) approached this type of teaching with a very critical eye. They found focusing on student- centered learning disturbing as it disempowered the teacher and empowered the student. Student-center learning gave the students' voices more authority, while muting the teacher. It was felt that this type of learning was brought about due to political involvement more so than actions, thoughts, and needs of educators (2013, p. 46).

Stockalingam, Rotgans, and Schmidt (2011) stated that not much has been mentioned about the format of problem-based literature or the instructional design format. The learning environment results in the need for an active, well performing cognitive working memory for learners to experience and interact with instructional materials and carry out the influences on extrinsic cognitive load while learning and using multimedia for studies on the cognitive loads in a constructivist's environment. As discussed before, the special needs students with working memory deficits by working independently or in a group trying to problem solve using higher order thinking skills without accommodations is very difficult. The belief that one teaching methodology would be the panacea to correct the errors of the education system when dealing with so many variables would be a skewed perspective.

There are still proponents of direct instruction (DI) who see little efficiency in having learners solve problems and target novel concepts before receiving any direct instruction in the concepts of problem-solving. Some educators may argue that there are situations in which students need to be shown what to do and how to do it. Some situations include the lack of skill that may need more practice, being unfamiliar with formulas, or experiencing frustration or lack of motivation. These arguments persist even though facilitated complex problem-solving and lecture practice student informants fall significantly below those students who are involved in productive failure curriculum, where students solve complex problems in small groups with minimal structural facilitation. Special education students may have working memory deficits, behavioral issues, auditory processing delays, speech and language deficits, and dyslexia or dyscalculia. Preparation for future learning involves combination of instruction that includes direct instruction, and prepares students for the role of failure in learning but also provides a provision for external support and scaffolds for student success (Kapur, 2010; Kapur 2012). Cole and Wasbum-Moses (2010) felt that the teaching of mathematics through correctness instruction belonged to special education classrooms and the inquiry-based teaching belonged to general education classrooms. Both general and special education teachers were being taught completely different approaches to mathematics for their classrooms. The special education teachers reported that they had a lack of materials and support when they were teaching mathematics (2010, p. 14).

In education, according to Sockalingam (2012), the various stakeholders such as students, parents, and later prospective employers are concerned about the quality of education students are receiving. Parents are always concerned about the quality of education for their child. Potential employers are concerned as to whether or not the students will be equipped with the appropriate workplace knowledge. It is important at this juncture to get feedback from both parents and students to identify the areas of strengths and areas that need improvement in the teaching service and learning process. The student's feedback can provide insights into the student learning experience and provide information as to what student is actually learning. There are those that argue against using student information surveys regarding student satisfaction and performance due to the use of grades to measure the quality of education. Students are primarily selected into higher education by their grades and surveys are not seen as big indicators for future academic success. Grades are a direct measure of a student's knowledge and are used as an estimate of the student’s learning. Grades have been linked to student satisfaction and permanent student retention. Grades and student satisfaction can also be attributed to teacher involvement and class and curriculum structure. Not enough information has been gleaned from surveys taken to determine the relevance in this process.

Multiple Intelligences

Howard Gardner (2006) believed that human cognitive competence could be described in terms of modalities, talents, or mental skills, which he called intelligences. He stated that all normal individuals have each talent or skill to some extent but the degree will differ within each individual and in a combination of ways. Multiple Intelligences theory normalizes the traditional intelligence. Gardner stated that intelligence has a "computational capacity-- a capacity to process a certain kind of information-- that originates in human biology and human psychology" (2006, p. 6). Armstrong (2009) stated that multiple intelligence theory was not a type theory for determining one's intelligence but is a theory of cognitive functioning and he advocated that each and every person has capabilities and capacities in all eight intelligence (2009, p. 15). Armstrong believed multiple intelligences could be developed in most people. Intelligence development depended on three main factors: 1) Biological endowment-- including heredity or genetic factors and insults or injuries to the brain before, during, and after birth 2) Personal life history-- including experiences with parents, teachers, peers, friends and others who awakened intelligence, keep them from developing or actively repress them 3) Cultural and historical background-- including the time and place in which you are born and raised in the major state of cultural or historical developments in different domains (Armstrong. 2009, p. 27).

Musical intelligence can be, for example, a child prodigy that can be supported by a biological link. Gardner (2006) believed autistic children who could play a musical instrument beautifully but could not communicate is an example of musical intelligence. By the definition he stated, musical intelligence deserves consideration; and in view of the data its inclusion is supported as an intellectual skill (2006, p. 9).

Body-Kinesthetic intelligence is “control of body movement is localized in the motor cortex, with each hemisphere dominant or controlling bodily movements on the contra lateral side. Body movement goes through a development schedule in children; it appears that body-kinesthetic “knowledge” satisfies many of the criteria for intelligence” (Gardner, 2006, p.10). This is where your muscles appear to have their own mind or memory, when athletes perform the same movements over and over to ensure their muscles remember the movements.

Logical-Mathematical Intelligence in gifted individuals is often rapid. The form of intelligence which has been thoroughly investigated by psychologists, and it is the archetype of raw intelligence or the problem-solving faculty that purportedly cuts across domains. The actual mechanism an individual uses to arrive at a solution to a logical-mathematical problem is not completely understood nor the process involved (Gardner, 2006, p. 12). By the age of six or seven, Gardner (1983) states that child has reached the level of Piaget’s young mathematician-to-be in equating two arrays on the basis of number. The child has, in effect, created two mental sets or mental images—two arrays.

The student is then capable of an action of comparison-contrasting of the number in one set to the number (1983, p. 131).

Linguistic Intelligence passes the empirical test and is consistent with the stance of traditional psychology. A person can understand words and sentences, but can have difficulty putting words together in anything other than simple sentences. The gift of language is taught (rapid and unproblematic, developmental in most children, even in deaf population where a manual sign language (Gardner, 2006, p. 13). Gardner stated "all normal children and a large proportion of retarded ones as well, learned language according to the outlined scheme, usually within a few years" (2006, p.80). He also stated that language is a special process, operating according to its own rules, and at the same time posing difficulties for scholars who want to argue (as did Piaget) that the acquisition of language simply invokes general psychological processes (Gardner, 1983, pp. 80 – 81).

Spatial Intelligence is required for navigation and for the use of the notational system of maps, solving or visualizing problems from different angles, and playing chess (Gardner, 2006, p. 14). There are few child prodigies among visual artists, but there was a child, "Nadia, a preschool student, who despite severe autism, made drawings of the most remarkable representational accuracy and finesse (Gardner, 2006, p. 14). Many special education students have spatial difficulties especially noted in their hand writing and lack of personal space.

Interpersonal intelligence builds on the capacity to notice distinctions among others like their moods, temperaments, motivations, and in tensions. Interpersonal intelligence does not depend on language (Gardner, 2006, p. 15). This is very difficult for special needs students to read personal facial moods and understand sarcasm or expressions.

Intrapersonal intelligence is knowledge of the internal aspects of a person, like knowing your own feelings, range of your emotions, the capacity to know the difference between the two and how they guide one's behavior (Gardner, 2006, p. 17). A special needs student may not know how to express how they are feeling or what they are feeling. They may not have the vocabulary to express the feeling and they may not understand.

Adults have a repertoire of skills to solve different types of problems. Gardner (2006) suggested that adults depend largely on a single intelligence, but every cultural role in any degree of sophistication requires a combination of intelligence (2006, p. 22). Educators need to use whatever learning style or modality it takes to get the grade level curriculum and standards across to all students. Armstrong (2009) stated that to "reject multiple intelligence theory as not research-based because there are no appropriately precise research studies that attempt to mimic research from the hard sciences is to deprived children of a wealth of positive interventions that could open doors to the world of knowledge" (2009, p. 195). Knowing and understanding how a student learns empowers not only the educator but also the student.

High-Stakes Assessments

NCLB and Individuals with Disabilities Education Act (IDEA) were crucial in holding schools accountable for students' learning including students with disabilities, and ensuring assessments were accessible to students with disabilities. These assessments should include appropriate testing administrations accommodations ensuring that students with disabilities have access to the testing process to demonstrate their achievement (Cho & Kingston 2011; Englehard, Fincher, & Domaleski, 2011; Pei-Ying 2013).

Some special needs students participated in an alternate assessment. This alternate assessment intended for the students with disabilities to be able to participate in high-stakes assessments with and without accommodations. These assessments were linked to grade level content standards but had a different complexity and scope. These assessments provide for students who were capable of performing at grade level, metadata format other than the traditional assessment to demonstrate their knowledge and skills. As some students fall into the gap between general assessment and alternate assessments; the students would not show proficiency and yet are not assessed appropriately due to not having an IEP or are in the process. NCLB gave states the option of either providing an alternate assessment or participating in the alternate assessment. However the disability has precluded the student from achieving grade level standards and the student must have been on and IEP. The alternate assessments are required to cover the same breadth and depth of other grade level assessments. Both NCLB and IDEA requires students with disabilities access to the general education classes and curriculum. The states are expected to provide the assessment to show what students know across all content area and to help guide instruction for accountability (Stecher, et al., 2010, pp. 1–2). Student assessment and proficiency fluctuate greatly within each disability and among each student. All disabilities do not have the same effect upon students and assessment outcomes. Students with intellectual disabilities often have significantly lower test scores than students with other disabilities.

Englehard, Fincher, and Domaleski (2011) stated that both state and federal requirements to include all students in high stakes statewide assessment created a variety of measurement issues. The commitment to provide access to these high stakes assessments for students with disabilities is viewed as significant progress for students with disabilities. Taking this commitment forward into practice is a challenge for measurement theorists and practitioners. The key is to provide access to the standardized assessment using accommodations to the test without invalidating the scores.

The research of Englehard, et al., (2011) examined "the effects of selected accommodations (resource guides and calculators) on mathematics performance assessments in grades three and four, six and seven" (p. 26). The resource guide consisted of a single page that provided key definitions and examples that the committee of assessments, curriculum and special education specialists thought would be helpful (2011, p. 28). The data suggested that students with disabilities and the conditions in which the tests are given have a statistically significant effect on math performance. The meanings indicated that students without disabilities do not differ significantly while students with disabilities exhibited the highest adjusted mean when they used calculators as an accommodation (2011, p. 30). For students with disabilities, and the accommodation of calculators do have statistically significant effect on the performance. Whereas the resource guide for math was not effective for students with disabilities

(2011, p. 34). Students cannot read the resource guide nor can they understand the academic vocabulary, which is does not eliminate the math deficit.

Cho and Kingston (2011) believe teachers are under such pressure for student achievement that taking the time and resources to instruct students with disabilities that it detracts from their ability to prepare assessments for general students without disabilities. The teachers are under great pressure for the class and students to meet annual yearly progress (AYP). On the other hand, some teachers may have low expectations for students with disabilities. With the absence of evidence to the contrary, teachers should assume that the poor performance on the high stakes assessment is due to instructional deficits rather than the students deficits (2011, p. 9). Burton (2010) stated that students can solve meaningful problems and assessments by using manipulatives, drawings, or technology (2010, p. 94). The decision as to whether or not a student is eligible to participate in the alternate assessment should be made annually during the IEP meeting and based on multiple assessments and standards-based IEP goals.

In order for problem-based learning and assessment to be successful, students must take responsibility for their learning. If this process increases in K-12 settings, it is believed that teachers who are equipped with the knowledge and skills of how to provide needed support will be better prepared to help student achieve success. Their ability to ask critical questions will ensure able educators to correct misconceptions and distinguish primary from secondary issues, while achieving better scores on unit tests from peers who make less constructive contributions (English & Kitsantas, 2013; Kamp, et.al. 2013). Believing problem and project-based learning was the direction the CCSS were headed as well as Standards Based Assessment Consortium (SBAC), it was difficult at the time to know the impact this would have on high stakes assessment. Once the SBAC had established a baseline for the assessment during the school year 2013-2014, using accommodations embedded within assessment, teachers and administrators had the opportunity to establish problem-based learning within the mathematics classroom. The purpose of the common core standards according to Porter, McMaken, Hwang, and Yang (2011) was to drive instruction by setting the goals to be taught in the content area. Mathematics common core standards will increase emphasis on basic algebra and geometry in Grades 3 through 8 and ensure that students are successful in mathematics beyond school.

Fisher, Z. Z., Bailey, R. R., and Willner P. P. (2012) stated that their research in fact indicated that the benefits of technology and training were found while the participants were learning problem-solving strategies. A fact was discovered that the calculator was able to help impulsive students obtain a level of self-control that they had previously not been able to obtain. Training on the use of a calculator could be incorporated within the school day (p. 297). According to Walcott and Stickles (2012) stated that the National Council of Teachers of Mathematics incorporated technology into instruction and assessment for all students. Although mathematics educators continue to disagree on how to reach a balance in response to calculators and technology use, in particular how to use of calculators during teaching and assessing mathematical concepts, and the benefits from the use of calculators on standardized achievement tests.

Enhancing student mathematical thinking skills as opposed to the use of the calculators, for computational processing, according to King and Robinson (2012), needs further research in mathematics (p. 4). According to Walcott and Stickles (2012) research had been conducted by the National Assessment of Educational Progress (NAEP) for Grade 4 and 8 math achievement assessments. The calculator was used to investigate the differences in achievement scores and results showed that the eighth-graders benefited the most from the use of the calculator on problem-solving items. In the year 2007, 60% of Grade 4 teachers reported that they restricted the use of calculators within the classroom. During that same year 30% of Grade 8 teachers also reported the use of calculators and math instruction. With these statistics, it would be safe to assume that roughly 30% of Grade 4 and 8 students never got to interact with calculators as a part of the regular mathematics instructions, whereas only 1-5% of high schools disallow calculator use not only in the classroom but also on assessments. Integrating calculator use and to classrooms results in students increasing problem-solving skills and number sense, as well as increased enthusiasm towards discovery and confidence about mathematics.

According to Pei-Ying (2013) English language learners (ELL) students with disabilities and an IEP were permitted to use accommodations during assessments, but students without IEP's could also have temporary conditions that prevent them from taking the assessments and use temporary accommodations. A hand injury could preclude a student from taking the assessment without an accommodation; a student just entering the country may receive special permission for accommodations (2013, p 2).

Neurodiversity in the classroom, according to Thomas Armstrong (2010) created a monolithic structure called special education which has its own unique and separate from general education system training program, its own diagnostic tests, its own special instructional programs, and its own jargon used when talking about educational issues (2010, p. 183). Meetings are held to discuss students' deficits and dysfunctions rather than their strengths and talents and abilities. Both general and special education students can have trouble in the general education class. They can find it very restrictive due to the labor intensive requirements imposed for academic achievement based on performance on classroom requirements and standardized testing. There is not much room for students to be a whole person which exercises their physical emotional, creative, cognitive, and spiritual capabilities (2010, p.187). Despite their disabilities special education students are required to take standard proficiency assessments along with the general education classroom with and without accommodations. The emphasis is placed on the standardized tests and pressure is being placed on special and general education students forcing them to spend hours each day preparing to take the high stakes assessment instead learning and becoming a successful neurodiverse individual (2010, p.189). These expectations are unrealistic that all children can achieve a given assessment score on any particular are given date.

Middle School in Rural Central California

There is a school district in Central California that consists of two elementary schools and one middle school. The rural community is located in the San Joaquin Valley. The middle school's enrollment is between 875 and 900 students. Of this student body, students with disabilities make up 10.6%, (ELLs) 54.9%, and socioeconomically disadvantaged students are the remaining 89.6%. The textbooks purchased and used for math instruction in all the math classrooms at the middle school addresses state standards and each student is provided with a textbook to use in the classroom and at home which is in compliance with California's Williams Settlement Act as well as requirements of NCLB. The Williams Act was a lawsuit filed in San Francisco County Superior Court in the year 2000 by Eliezer Williams and one hundred San Francisco County students. The suit was against the state of California and California Department of Education (CDE) due to these agencies not providing public school students with equal access to instructional materials. The case was settled by the state allocating $138 million dollars for instructional materials that were aligned to the state standards. Due to the results of the Williams case, the CDE proposed changes to the School Accountability Report Card (SARC) template, which mandates all schools to complete and publish the results annually. This Williams Act reporting element requires all students to have instructional material (http://www.cde.ca.gov/eo/ce/we/wmslawsuit.asp).

The middle school has approximately 90 students with disabilities and four highly qualified special education teachers. One of the middle school's special education math teachers may see 50 to 60 students a day. The special education teacher instructs sixth grade, seventh grade, and eighth grade math within a seven period class day. The special education math teacher starts the math curriculum with sixth grade students and continues with the same students through eighth grade. The middle school has been in program improvement status since school year 1998-1999, due to their students, which includes special education students, performing poorly on the high stakes assessment (http://www.weaver. usd.k12.ca.us/school accountability report card – weaver middle). Cho and Kingston (2011) stated most students participate in the high stakes assessments with and without accommodations and that students with the most significant cognitive disabilities take an alternate assessment. Alternate assessments continue to have grade level standards but differ in the layout on the page or the number of questions or answers from which to choose (p. 59). The middle school's special education students also have to comply with the same high stakes assessments required by California Department of Education.

The middle school has transitioned to CCSS as other schools have chosen to do. The middle school started this transition process during school year 2012-2013, with just the Grade 6 math classes using College Preparatory Math (CPM) Course One. All Grade 6 math teachers, including a special education teacher, were trained in the common core standards and progressions during the San Joaquin Valley Mathematics Project Summer Leadership Institute 2012, and were also trained how to teach/present the CPM materials being used in their classroom, while continuing to implementing the CCSS. Common Core math training for school year 2013- 2014 included all math teachers of Grades 6 through 8 including special education. The training insured teachers understand how to prepare their students for critical thinking skills and became aware of the time needed when accommodating students with memory deficits, cognitive processing delays, and anxiety or behaviors to prevent students from shutting down and not participating in class because they do not know algorithm math facts, which preclude students from the discovery process. These behaviors and disruptions should be a thing of the past with the use of available technology and appropriate accommodations.

Students should not have to continue to spend extra minutes a day just on basic math facts, as has been the practice for the past five to six years, without the possibility of retaining these same facts. Using a calculator or other technology to help them with the calculations would leave the students' time to explore math concepts and work with abstracts and unknowns. Teachers could then become facilitators of learning according to Marshall and Horton (2011), where students could engage in mathematics, explore and investigate concepts, and explain and justify how they understand and resolve real-world situations that was presented through a mathematical lesson or performed during a group task (2011, p. 3). The objective is to keep students engaged and excited about what they are learning.

In any classroom, at any given time, there may be students with mild and moderate disabilities and teachers who attempt to provide each student with the appropriate education in the least restrictive environment. These disabilities may include deficiencies with long or short term memory, along with deficits and/or cognitive processing delays. These deficits or delays often make it difficult but not impossible for students to remember and retrieve information. Learning concepts that give students knowledge and skills to problem solve may cause anxiety among some students and can cause others to shut down and not participate. Students that have repeatedly experienced failure lose the desire to expend any effort to learn. Students may require high levels of support from educators, classmates, and others to be included in classrooms while meeting the demands and expectations of the curriculum and standards (Carter, Prater, Dyches, 2009; Calculator & Black, 2009). During the early years of elementary school, Burton (2010) found students can have success by charting daily activities, using graphs, manipulatives, diagrams, charts, and writing numbers using multiple ways in which are meaningful for each student (2010, p. 94). The middle school's special education math students have been using manipulatives, such as multiplication flashcards and charts to help them learn algorithm math facts. They use flash cards either alone or with a partner. They practice with parents or on computers using math fact programs and have done such since Grade 3. These same students have not seen improvement or minimal improvement in their calculations due to their disability. These same students continue to use the multiplication chart in middle school. Some students think they have become almost experts in the use of the multiplication chart for multiplication facts but continued to have difficulty using this same chart in reverse for division. Students have created these same multiplication charts using blank formats or grid paper by well-meaning teachers. If a closer look is taken at the charts, many times there will be little marks in the boxes where the student used repeated addition for counting rather than multiplication to get the results to fill their blank multiplication chart.

Carter, Prater, and Dyches, (2009) felt that students were primed for months before a high-stakes tests as though they were getting ready for battle. Test anxiety has grown and its prevalence means that the tests producing this reaction are not giving us a good picture of what many students really know and can do (2009, p. 12). Using a calculator to relieve calculation frustration, the students could concentrate on higher-order thinking skills and justifying answers rather than becoming anxious over not knowing basic calculations, giving up, becoming disruptive, or having to be removed from class. Dray (2011) stated that behavior in the classroom, student engagement, and classroom management affects the way that students and teachers interact as well as assessment results (2011, p. 1). Most high stakes assessments have very few basic calculation problems. Calculations are embedded within word problems, algebraic equations, or geometric figures and need to be solved using higher-order or critical thinking skills. Students need to practice these skills and not quit because they can't perform the calculations. Students need to practice calculations daily using a calculator in order to understand how to make appropriate keystrokes to solve multistep operations. Knowing the basic operation of a calculator, which key stroke applies to which mathematical operation, could help students progress past the frustration of not knowing basic calculations and allow the student to focus on mathematical discoveries while using higher order thinking skills during real-world applications.

Dodge (2009) as well as Schulte and Stevens (2013) believed as curriculum gets more involved in the middle to upper grades, teachers are pressured to increase scores to improve the schools profile. The teachers are spending inordinate amounts of time prepping for high-stakes assessments. This type of pressure for students to become advanced and proficient on high-stakes testing without the use of appropriate accommodations is devastating for special education students and can be nearly impossible for the special educator.

During an IEP meeting, the team confers with student and parent ensuring that student's needs are met in an inclusive or a special education setting; De Schauer, Van Hove, Mortier, and Loots (2009) stated that teachers both or either special education and general education, may not understand the student's needs the parent plays an important role as mediator. The attitude of the teacher and student are crucial in the experience the student will have during inclusion in any general education or special education classroom. Students know which teachers know and understand the struggles of a student and are willing to help meet the needs of the student. When the teachers are willing to slow the pace of the lesson or are flexible with the learning arrangements, the special needs student and parent are always grateful (2009, p. 100). Students can and should be able to be included in the everyday school processes.

The use of technology or a calculator for high-stakes testing is imperative. It is included in students’ daily use, ensuring access to grade-level curriculum in both general and special education classrooms. California's math achievement scores for special education students have not kept pace with those that are a requirement of NCLB with or without accommodations. Dodge (2009), argued that the NCLB mandate had been supported by the public because they felt the mandate was a phenomenon, that occurred when students were assessed and the event was used mental to over simplify a complex issues and promoted standardized tests as the panacea for the problem of the public school system. The researcher claimed that the premises are suspicious and examines their harmful potential for diverting resources, distracting educators, and alarming children (2009, p. 6). Brown (2010) stated that using calculators clears away the algorithmic rubbish so that students can spend more time understanding where the information goes which leads to a better understanding of how to interpret questions and how to use the information provided (2010, p. 192).

The stress and significance placed upon students with high-stakes assessments have many of the special education students acting out or shutting down; due to the fact they do not know the automaticity or the algorithm for the required calculations. However, the disruptions can be eliminated with the use of technology or with calculators if given to students when needed confidence rises to be able to continue with the mathematical process and willingness to discover (Armstrong, 2000, pp. 95 – 97). Common core assessments have embedded universal tools that include calculators. Students need to use calculators in their daily classroom routine as a part of their learning to understand how to properly use the tool and ensure they can justify their answer and that their answer makes sense. These questions need to be answered before a student uses the embedded tools during high stakes assessments.

Summary

This research addressed the educator's mindset, whether they were open to the use of technology in the classroom or on assessment or had the closed mindset to the continual use of pencil and paper and the rote algorithms to learn mathematics. There were discussions and strategies for considering problem-based learning, inquiry-based learning, and project-based learning. Each of these strategies recommended educators became more as facilitators of student learning then, direct instructors and recommending that students become more involved in the discovery process of their own learning.

Although current research addressed pre-service teachers, more needed to be learned from seasoned teachers ensuring that their perspective and expertise would be utilized and taken into account. This would fill the gap in the literature where there appears to have limited research according the STEM teachers' perspective of the use of calculators or technology and students accessing higher order thinking skills, while using problem based learning, inquiry based learning, or project based learning.

Overall, many researchers discussed benefits of using the calculator when trying to achieve higher order thinking skills by using the scaffolds that are invaluable to student success (Monchai, Sanit, 2013; Kapur, 2010; Ruthven, Deaney, & Hennessy, 2009).

The next section describes the methodology of this research study. The reasons the research design and approach were established. Performing a case study; while using purposeful selection of STEM teachers and obtaining their perspectives on the use of calculators or technology in their classroom to obtain critical or higher order thinking skills through discovery, will provide useful information for general and special educator.

Chapter 3: Research Method

Introduction

Choosing the methodology that connects the purpose and one's study is imperative. Creswell (2013) recommended that researchers develop well-thought out research designs long before conducting their study. The purpose of this qualitative case study was to explore the perceptions of Grade 7 and 8 STEM teachers about using a calculator or other supportive technology by special education students for basic mathematical calculations as a conduit to learning higher order thinking. To accomplish that purpose, I investigated how STEM teachers' perceived students' performance or looked at student's academic performance in their classrooms.

This chapter focuses on the research method for this study. It includes a description of the research design and rationale, the central and related research questions, the role of the researcher, participant selection, and instrumentation. In addition, procedures for recruitment, participation and data collection, the data analysis plan, issues of trustworthiness, and ethical procedures are presented.

Research Design and Rationale

A qualitative case study can be used by researchers to study their phenomenon within a group or by obtaining a "purposeful sample" (Patton, 2002, p.230). The purposeful sample selection was used to gather an in-depth understanding rather than generalizations. Yin (2009) stated that the design connects the data from the study's initial questions to its conclusion. Yin also described a case study as "an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (p.18). Yin argued that case study design should be used in qualitative research when the boundaries between the phenomenon and the context are not clear. Yin maintained that case study research can be used to understand real-life situations. To understand a phenomenon and its context in real-life situations. Yin recommended case study research because multiple sources of evidence can and should be collected and analyzed to provide a rich description of the case.

I selected the case study design because I want to explore the phenomenon of teachers' perception about using technology by students who have working memory deficits. The questions I answered through this research were:

Question 1: What are the teachers' perceptions of students with working memory deficits using assistive technology during classroom assignments and/or while taking assessments to access critical or higher order thinking skills?

Question 2: When working with students who have memory deficits, how are teachers' expectations the same or different when students have technical assistance to access higher-order thinking skills as compared with when students do not have technical assistance?

To explore these questions in depth, I collected data from multiple grade STEM teachers. The data collection included journals and surveys as well as interviews with general and special education math and science teachers.

These teachers were interviewed face-to-face, or by phone to evaluate their perspective on the effectiveness of the use of calculators in their classroom. Open-ended questions were used, giving the teachers the opportunity to express how they perceived that students achieved critical or higher-order thinking skills in their perspective classrooms.

There was not a pre or post assessment: rather, only teachers' opinions concerning their perceptions of special needs students' achievement of critical thinking skills in the classroom while using a calculator and/or technology were assessed. This case study used a purposeful sample (Patton 2002, p.230) of special education math and science teachers, Grade 7 and 8 math and science teachers who used calculators during classroom activities and assessments to explore whether critical or higher-order thinking skills were being achieved by special education students.

These interviews were recorded, transcribed, and openly coded. The data were analyzed to determined how the teachers, from both math and science, experience calculator use by students during the discovery process and whether they were achieving critical or higher-order thinking skills, while meeting or exceeding classroom expectations.

The goal of this research was to obtain STEM teachers' perceptions toward special needs students using calculators and technology in the classroom to obtain critical and higher-order thinking skills. Teachers understood that calculators may be used as accommodation according to IEPs, but research is lacking when it comes to educators' perspective and involvement toward technology and higher-order thinking skills and special education student.

Other qualitative research designs were considered for this study and rejected. For example, phenomenology was a research design used to understand the essence of experiences about a phenomenon (Creswell, 2013). This design relied on in-depth interviews with up to 10 people. This design was rejected because the purpose of this study was not to understand the essence, or nature of STEM teachers' perceptions of critical thinking skills; rather, the purpose was to understand the teachers' perception or ideas about strategies that students could apply to achieve according to their IEP. Grounded theory was also considered as a research design for this qualitative study. The intent of grounded theory was to generate a general theory that was grounded in the data analysis. This research design was rejected because the purpose of this study was not to create a theory.

Role of the Researcher

For this study, the major role that I assumed was that of a researcher responsible for the collection and analysis of data and the dissemination of my research findings to interested individuals. Because I am the sole person responsible for data collection and analysis, the potential for researcher bias exists. In order to limit this bias, I used specific strategies to enhance the trustworthiness of this study, included using member checks, triangulation, adequate engagement in data collection; I described those strategies in more detail later in this chapter.

I am currently employed as a middle school special education teacher, but I am not included in this study. I have a semi-professional relationship with some of the potential participants in this study, as we are members of the same department. I have been trained in CCSS and I am a math teacher. I am one of the Grade 6 special education math teachers, but I am not associated with the upper level math teachers in the department that is included in the study. In order to minimize my personal beliefs with the STEM program, I plan to maintain a journal in which I reflect on the decisions that I make during the research process in order to maintain a neutral position about the topic of this study.

Methodology

Participant Selection Logic

The research occurred in a rural middle school located in the Western coast of the United States. The school's enrollment is close to 900 students. Approximately 10% of the student body has disabilities, over half are ELLs, and almost 90% are eligible for free and reduced meals.

According to Patton (2002) there are no rules for sample size except that they should meet the purpose of the inquiry, be useful, and have credibility (p. 244). The possible sample size at this school was 14 teachers, both general education math and science Grade 7 and 8. It was my hope that at least 10 to 12 of those teachers would be willing to participate in this research. There were three Grade 7 general education math teachers, two Grade 7 general education science teachers, three Grade 8 general education math teachers, two Grade 8 general education science teachers, and four special education teachers, two teach math for two or more grade levels as well as co-teach science and the other two also co-teach science or social science, a very involved special education staff at this school with common core.

The purposeful sample was derived from the seventh and eighth grade STEM staff. ELA and Social Science (SS) teachers were not included in the STEM curriculum and were not a part of this research. This particular middle school staff in central California has been trained in and has been using common core math for 4 years.

Instrumentation

I interviewed the teachers face to face, if possible, but when they were unavailable for the face to face interview they could participate through the email. This process was set up to for them to participate through email (see Appendix A). The second instrument was the online reflective journal that I asked all participants to complete. To ensure that triangulation can occur, a third source of data was a survey sent to all teachers in the Stem program who was not be able to participate in the face-to-face interviews. I asked an expert panel, comprised of several colleagues with advanced degrees in education, which reviewed these instruments for their alignment with the research questions for this study. In this section, I described how I designed and developed these instruments.

Interviews were conducted and recorded at each teacher’s convenience within the allotted time frame. These interviews were transcribed and Microsoft was used to highlight the different patterns that appear. I looked for reoccurring answers to a possible solution or solutions that may not have been presented or obvious in previous research, while always keeping in mind my own personal bias. To ensure trustworthiness, all transcribed interviews were returned to the interviewees for member checking. Once they agreed that the transcription was transcribed appropriately, the interview became part of the data record. All pertinent information was protected and was kept in a locked file cabinet that has only accessible by me and computer files stored on a computer or a flash drive and was password protected.

Interviews

Merriam (2009) noted that conducting individual interviews with participants was one way to collect data in a qualitative study. Merriam (2009) also noted that interviews can be structured, semi-structured, or unstructured. For this study, I used a semi-structured format designed the interview questions in an open-ended fashion (see Appendix A). These questions begin with "how" or "what" or "why" so that participant responses to the questions would be descriptive. I also asked probing questions when necessary.

Reflective Journal

I also asked participants to complete an online reflective journal that includes three questions that I designed (see Appendix E). Participants were asked to reflect in writing on the impact of the use of the calculator or technology in their classroom by students with memory deficits. In addition, I asked participants for suggestions if they could improve on technology use and special needs students improving their access to critical thinking using this technology. I also aligned these reflective journal questions with the research questions for this study (see Appendix E).

Surveys

A survey was sent to each STEM teacher after receiving permission from Walden's IRB (see Appendix D) the letter details the purpose of the study accompanied by each survey (see Appendix C). In the letter, teacher participants were notified that their participation in the study is voluntary. The participants were also assured that they had the right to terminate their participation station at any time. Their privacy would be respected and that their names would not be included within the survey instrument. Obtaining anonymity of the teachers and the school was imperative.

Validity and Reliability of the Instrument

According to Yin (2009) the interview questions were guided to pursue a consistent line of inquiry in hopes of that the conversation is fluid rather than rigid. This occurred over time ensuring that the respondent was relaxed enough to reveal key information that was critical to the success of the case study. Creswell (2013) defined validity as, "whether one can draw meaningful and useful inferences from scores on the instrument" (p.157).

In order to improve the trustworthiness of qualitative research, specific procedures need to be followed for recruitment and participation of participants that were aligned with the requirements of the Institutional Review Board (IRB) at Walden University. In addition, specific procedures were followed for data collection in order to maintain the trustworthiness of the findings. These procedures were explained in the section below.

Data Collection

I began the data collection process by conducting individual interviews with each participant. I conducted the interviews in person using the location of their choice, but ensuring privacy. Each interview was about 30 to 45 minutes in length. As a qualitative researcher, I wanted the participants to be at ease, and therefore, I would inform them that I would keep all of their responses confidential. I also audio recorded each of the interviews. At the end of the interview, I thanked participants for their support, and I reminded them that they would be asked to review their individual findings for this study for their credibility once they are ready for review.

For the reflective journal, I explained the data collection procedures to participants at the end of the interview. I emailed the participants the reflective journal questions within a day after the interview was completed. I asked participants to return their completed responses to me as an email attachment within one week. Once I received these responses, I sent an email thanking participants for their reflective journal data.

Data Analysis Plan

Data was not collected until Walden University IRB approval was received. Once that occurred, (11-11-15-0066625), I began interviewing the participants and collecting data. In addition I had the participants begin writing a reflective journal.

Data was analyzed at two levels. At the first level, it was a descriptive account of data. It was during this level of analysis that data were transcribed and decisions were made as to what would be included and what would be excluded.

At the next level of analysis, I constructed categories and identified themes using specific analytical techniques of coding and categorization. I used line-by-line coding as recommended by Yin (2009). I used content analysis for the document review, which involved describing the purpose of the document, its content and organization, and its use. I also presented a summary table of the categories for each data source.

As recommended by Merriam (2009), I used the constant comparative method to describe emerging theme and discrepant data. These themes and discrepancies were the basis for the findings of this study, which were analyzed in relation to the research questions and interpreted in relation to the conceptual framework and the literature review.

Data Analysis

Each transcribed interview was color coded using Microsoft Word. I was looking for reoccurring answers to possible questions that may not have been presented prior or obvious in previous research, while always keeping in consideration my own personal bias.

The goal of this qualitative case study was to explore the perceptions of Grade 7 and 8 STEM teachers to determine whether or not the use of supportive technology for basic mathematical calculations allows special education students access to higher order or critical thinking skills.

Issues of Trustworthiness

Cresswell (2013) used the word validation (p. 250). To ensure validity or trustworthiness, I built a relationship with the participants. I collected the information through semi-structured and focused interviews, surveys, and reflective journals for analysis of the same phenomenon.

Credibility

Merriam (2009) defined credibility as the alignment of the research findings with the reality of the participant as they are the source of the data in this research. Merriam recommended that researchers use the following strategies: triangulation, member checks, adequate engagement in data collection, and peer review. Triangulation involved comparing and cross-checking data through observations that were conducted at various times and places or interview data that were collected from different individuals with different perspectives. Member checks were also known as respondent validation, which meant that participants check the tentative findings of a study for their plausibility. Adequate engagement in data collection referred to the amount of time the researcher spends observing or interviewing participants in a real-life setting. Peer review consisted of an examination of the manuscript by others who were qualified and knowledgeable.

For this study, I used the strategy of triangulation by comparing and cross-checking interview data, reflective journal data, and a survey. In addition, I used the strategy of member checks by asking participants to provide feedback on their individual findings. I also used the strategy of peer review by asking several of my colleagues with advanced degrees in education to scan some of the raw data and determine whether or not the findings were plausible based on the data.

Transferability

Merriam (2009) defined transferability as the extent to which findings of one study can be applied to other situations. In order to improve the transferability of a qualitative study, Merriam recommended that researchers use the strategies of rich, thick description and maximum variation or typicality in the sample. The strategy of rich, thick description refers to a detailed presentation of the setting and findings of the study. The strategy of maximum variation in the sample means any common pattern that emerges from great variation is of particular interest and value in capturing the core experiences typicality refers to the average person, situation, or phenomenon.

For this study, I used the strategy of rich, thick description by providing a detailed description of the setting for this study, the participants, the data collection and data analysis procedures, and the findings. In addition, I used the strategy of typicality by selecting STEM teachers and their perception of whether the use of technology helps special education students obtain critical thinking skills.

Dependability

Merriam (2009) defined dependability as the extent to which research findings can be replicated. In order to improve the dependability of qualitative research, Merriam recommended the strategies of triangulation, peer review, and an audit trail.

Triangulation refers to comparing and cross-checking multiple sources of data. Peer review refers to the examination of the study findings by qualified and knowledgeable individuals. An audit trail means that the researcher maintains a research journal that includes a detailed description of the problems, issues, and ideas encountered in data collection and the decisions that were made during data collection and analysis.

For this study, I used the strategy of triangulation by comparing and cross-checking multiple forms of data. I also used the strategy of peer review by asking colleagues with advanced degrees in education and who are qualified and knowledgeable about using technology in the classroom to obtain critical thinking skills to review the findings of this study for their plausibility. In addition, I used the strategy of an audit trail by maintaining a journal that tracks how the data is collected and how decisions were made throughout the research process.

Confirmability

Confirmability for qualitative research was defined as objectivity. In order to improve the objectivity of a qualitative study, Merriam (2009) recommended that researchers use the strategy of reflexivity. Reflexivity refers to "the process of reflect critically on the self as researcher" (2009, p. 219). The researcher should explain any biases, dispositions, and assumptions that they have regarding their study. Merriam noted this allows the reader to understand how the researcher arrived at the interpretation of data

For this study, I used the strategy of reflexivity by explaining any biases and assumptions that I had concerning the use of technology in the classroom. I also planned to follow very strict data collection and analysis procedures to minimize any or most biases. I listened as carefully as I could to the participants as they discussed both the positive and negative experiences they had with the use of calculators or technology in the STEM classroom and how this usage may or may not have led to critical thinking skills for special education students.

Ethical Procedures

To insure ethical procedures are appropriately followed during this study, I first met with the individual(s) in the public school district (s) where the study took place to seek approval to collect data for this study (Appendix F). Once I had approval from the appropriate authority, I submitted my proposal along with an Institution Review Board (IRB) application and letter of cooperation to Walden University's IRB for approval to conduct research. I did not begin the data collection process until I had obtained IRB approval for my proposal. According to IRB standards, I need to maintain the highest integrity and confidentiality throughout this study.

Once IRB approval was obtained (11-11-15-0066625), I asked the school principal to provide me the names of potential participants for this study. I emailed a letter of invitation to all potential participants (Appendix B) explaining the purpose of this study and asking them to sign and return an attached consent form either electronically or in an envelope sent through the mail. The consent form indicated that their participation in this study was voluntary and they could withdraw from the study at any time without consequences.

When the consent forms had been returned to me, I contacted each participant by telephone, in person, or email to schedule the individual interviews. During this same time I explained the reflective journals, how they would be collected and how the data from the reflection journal would be used. I would again remind participants that responses would be kept confidential, and I would use pseudonyms for the participants, the school, and the school, and the school district.

To ensure confidentiality, all data were stored in a locked file cabinet in my home and any electronic data were kept on my password protected personal home computer. My Walden faculty mentor, Dr. Birnbaum, methods individual, Kevin Higa, and I were the only individuals who have access to the data. All original data and documents from my study will be destroyed after a period of 3 years.

Summary

In summary, this chapter provided an overview of the research method that I used to conduct this study. A case study design was chosen for this qualitative research study because Yin maintained that case study research can be used to understand real-life situations and multiple sources of evidence can be collected and analyzed in order to provide a rich description of the study. In addition, this chapter included a description of the role of the researcher, participant selection, instrumentation, procedures for recruitment and participation as well as data collection, the data analysis plan, evidence of trustworthiness, and ethical procedures.

Grade 7 and 8 STEM teachers were interviewed about their perception concerning using a calculator or other supportive technology by special education students for basic mathematical calculations as a conduit to critical thinking skills. Details regarding teachers' participation, instrument, data collection and analysis were also provided. The research methods that were used followed the suggestions of Creswell (2013), Merriam (2009), and Yin (2009) to ensure validity of the study.

Chapter 4: Results

Introduction

This chapter presents a detailed overview of the data collected from data gathered through this study. Potential participants were identified from a list of Grade 7 and 8 STEM teachers, provided by the administration of Western Road Middle School (pseudonym). E-mails were sent to potential participants inviting them to participate in the research. Information gained from the reflective journals and surveys were analyzed and used to draw the conclusions presented in this chapter.

The purpose of this activity was to answer the following questions:

1. What are the teachers' perceptions of students with working memory deficits using assistive technology during classroom assignments and/or while taking tests to access critical or higher order thinking skills?

2. When working with students who have memory deficits, how are teachers' expectations the same or different when students have technical assistance to access higher-order thinking skills as compared with when students do not have technical assistance?

The following topics are covered in this chapter: (a) the research setting, (b) participant demographics, (c) the data collection process, (d) reflective journals, (e) surveys, (f) findings, (g) results, and (h) summary.

Setting

The research site for this study was a rural middle school district in the San Joaquin Valley, California. This middle school's enrollment is between 900 and 950 students and approximately 85 to 90 students are identified with disabilities with four highly qualified special education teachers supporting the identified students. Western Road School started the transition to common core standards including using technology during 2012 – 2013 school year, with only the sixth-grade math classes using College Preparatory Math (CPM) Course One. Each student had access to Chromebooks in every sixth-grade class room during 2013 – 2014 school year.

During the 2015 – 2016 school year, all students at Western Road Middle School had access to Chromebooks. Every classroom had a Chromebook cart which houses and charges Chromebooks for every student. These Chromebooks include Wi-Fi accessibility and text to speech capabilities. When teachers upload their assessments on the Chromebook, students can use their earbuds or earphones to have assessments read to them. These carts of Chromebooks are available after school, during homework support, or for afterschool tutoring, as many of the assignments have been downloaded onto each teacher's Google classroom. Assignments are uploaded to the Google classroom to be completed on Chromebooks using Google Docs and turning the assignments in through the appropriate established teacher's Google classroom. The Grade 7 and 8 science textbooks have been made available on the school and classroom web pages. Students with computers at home could be given a CD instead of textbook. The student could upload the CD of the science text onto their computer instead of having a textbook at home. The school is trying to use technology to ensure textbooks are accessible to every student in multiple ways.

Participants' Demographics

Potential participants recruited for this study were Grade 7 and 8 STEM teachers located in Western Road Middle School in central California where I teach. However, my position as a special education teacher is not a part of this research project. The superintendent granted me approval to conduct research within the Western Road School District. I was also given permission to contact Western Road Middle School administration to obtain the names of the 2015 – 2016 school year STEM teachers. The Western Road Middle School administration provided a list of the Grade 7 and 8 general education science and math teachers, and special education teachers. A total of 13 teachers were eligible to participate in the study. The list included three special education teachers and ten general education teachers. I made a reference list for all STEM teachers and gave them a teacher number to ensure anonymity. I also annotated the reference list with the date the signed letter of intent was returned and the date I received the completed survey or the journal.

The middle school's general and special education math instruction consists of two period blocks. At this particular time, special education has two teachers who teach math, one teacher who teaches Grade 6 and the other who teaches Grade 7 and 8. The Grade 7 and 8 resource classes have between 23 to 25 students in either class at any time. The other two special education teachers teach ELA to Grade 6 through 8. The ELA classes, unlike math, are single period classes. One special education teacher teaches

Grade 6 science and social science and the other teacher instructs Grade 7 and 8 social science classes. All four special education teachers alternate every other week with study skills or study hall class, taught during the last period of the day (period nine). Three out of the four special education teachers have received an invitation to participate in the study, based on the criteria presented in chapter 4, of which, only two signed their participation form one math (T12) and one ELA (T11) and returned their completed reflective journals.

I emailed participation letters to 10 general education Grade 7 and 8 STEM teachers, which were provided to me by the Western Road Middle School administration. I received eight signed participation forms. Once the signed participation letters were returned, the surveys and reflective journals were emailed to those participants. The STEM teachers breakdown are as follow: (a) seventh-grade science one female (T1), one male (T2), (b) eighth-grade science one male (T3), one female (T4), (c) seventh-grade math three female, of which only one participated (T6), (d) eighth-grade math two male and one female, of which only one male (T10), and one female (T8) participated. The data were collected over a two week period, special education both are female (T11) and (T12).

Data Collection Process

Data for this research project were to be collected through face-to-face interview, survey, and reflective journal. Face-to-face interviews were conducted during a one week period in February, I interviewed nine teachers. The participants also answer the questions from Journal and survey within my time constraints. All the participants answered the questions on the reflective journal and five answered the open ended survey question. Four teachers--two special education and two general education--emailed me their completed surveys and/or journals, three general education teachers typed their response on the form, printed it, and sent it to me in my teacher box in the teacher lounge. One general teacher printed the form and hand wrote the response and gave it to me as we passed in the hallways. The copies of the forms that were not electronically sent, I scanned those copies into my database to have an electronic copy. This ensured that I had both a hard copy and an electronic copy. The electronic copies are password protected on my computer in my office at home, and the hard copies are kept in a locked file cabinet, also in my office at home.

Data Analysis

Once I had collected all of the participants' surveys and reflective journals, I began the coding the first level of descriptive account data. These questions, from the teacher's perspective would provide insight into two student struggling to learn higher-order thinking skills in pre-algebra and algebra and their ability to complete multiplication and division algorithms at grade-level. Also, addressing the mindset of teachers and how using technology allowed students to access higher-order thinking skills. All transcribed reflective journals were color-coded using Microsoft Word looking for reoccurring words within each question. This same technique was used with the open ended survey questions. Each reflective journal question (JQ) survey question (SQ), and Interview question (IQ) were used as the category to be answered. Within each category, there appeared to be a positive and a negative theme and each category was nonspecific to either general education or special education teacher's perspective. This allowed me to look for a positive and a negative outcome for each question and determine, if teachers perceived that the positive use of technology outweighed the negative output. These results were put into an Excel spread sheet for easy visibility and continuity.

Reflective Journal is

The specific themes that emerged from the data using the interview questions (IQ), journal questions (JQ) and survey questions (SQ)

1. What are the teachers' perceptions of students with working memory deficits using assistive technology during classroom assignments and or while taking tests to access critical or higher-order thinking skills?

The positive thread was that technology provided, "students access to critical thinking skills that they were lacking," according to T10 and T3. Technology stated by T4, "Encourage students to try and give them the opportunity to free their thinking from a numerical task and words toward advanced thinking skills." The negative response according to T2, "students are very distracted and shut down and do not try."

2. When working with students who have memory deficits, how are teachers' expectations the same or different when students have technical assistance to access higher-order thinking skills as compared with when students do not have technical assistance?

The theme here was the same among all but one of the STEM teachers. Their expectations were the same for all students. They expected students to perform their best at all times. T3 stated, "When the students have technical assistance, my expectations for the students are usually the same. They are capable of using higher-order thinking skills to solve problems and to create solutions. Technology does not appear to hinder the learning process. It just allows them to avoid a hurdle altogether that sometimes interferes with their new learning."

The purpose of the reflective journal was to provide the participants, Grade 7 and 8 STEM teachers, and special education teachers, with the opportunity to give a written response to include their reflections towards technology use in the classroom and the impact of technology for academic use, while reflecting and thinking about students' technology use in the classroom. Participants' reflective journal (JQ) responses data follows:

JQ 1. What are your perceptions of students with working memory deficits using assistive technology during classroom assignments and/or while taking tests to access critical or higher order thinking skills?

Seven of the nine reflective journal responses, reflected yes, that technology can assist students with working memory deficits to access critical or higher order thinking skills. While one teacher stated no, that technology does not appear to assist students' access higher order thinking skills. Another teacher stated that there appeared to be no difference when students use the technology, the results were the same. Teachers T3, T4, T6, and T8 stated both yes and no. T3 stated no, due to "climate in which they work within." T4 stated no, because students would shut down without the technology. T8 stated no, particularly when students do not have a good sense of numbers. T3 also stated yes, technology does assist students to be successful accessing higher-order thinking skills. T4 stated yes, “students are comfortable in solving problems requiring higher-order thinking skills." T8 stated yes, when students have evidence of numbers. T6 stated yes and no and summed it up this way," students are more engaged, but do not seem to access higher-order thinking, although they can access skills they are lacking and that may free up their concentration to allow room for higher-order thinking.” The success of the student appeared to be class to class and situation to situation, not a clear decision, but is a separation between general and special education perception.

Training is also an issue. Six of the nine teachers stated that training for both teachers and students with the technology should be a requirement. T2 acknowledged that when referring to student use of calculators in the classroom, "students need to be taught how to enter information into the calculator itself. Students enter the information in the wrong order and the calculators give them incorrect information.” T12 stated “students should be taught how to effectively and efficiently use technology.”

General and special education did not agreed on whether technology was/was not a distraction. Three of the general education teachers that answered this question stated that they felt technology was a distraction. The two special education teachers stated that technology was not a distraction but a tool or an accommodation needed for the student to have access to the grade-level curriculum.

JQ 2: When working with students having memory deficits, how are your expectations the same or different when students have technical assistance to access higher order thinking skills as compared to when students do not have technical assistance?

Seven of the nine teachers surveyed stated that their expectations would be the same in their classrooms whether the student did or did not use technology to complete assignments or assessments. One general education teacher stated she lowered her expectations for all special education students whether they did or did not use technology, and on the other hand, one special education teacher stated she raised her expectations when using technology with the students.

JQ 3: Did students meet or exceed your expectations?

T8 was disappointed by most students and their use of technology as it became a toy no matter what kind of parameter that was used in the classroom. As a teacher, there were high hopes for engagement and learning for every student. This teacher felt that technology became a stumbling block rather than a tool. T2 stated that students have consistently failed to meet classroom expectations. The other five teachers stated that their expectations for all students were met through the use of technology in their classrooms. Only one teacher did not answer the question.

JQ 4: Could you have done anything different and will you do anything different?

All nine teachers responded with concerns of not having enough training on the technology that they were using in the classroom, not only for them but for their students as well. All of these teachers stated they were always looking for something different to include in the classroom. They rarely teach the same way twice over the different years except when a method proves to be successful on a continuing basis. They are always open to new and better method of improvement instruction in a manner that is always allowing students to succeed. T3 stated that if "he was not willing to make changes, just proves that it would be time for him to move on."

The teachers will continue to make accommodations and modifications required by the IEP process. While using real world experiences, teachers will continue to try to decipher or figure out the types of support and scaffolding each student will need for success. Although T3 is not in complete agreement, he stated, "the greatest roadblock to student success are general and special education personnel, who appear to truly believe that students are incapable of being successful and communicate those beliefs either verbally or through actions to the students." Educators need to ensure that all students believe in themselves and their success.

JQ 5: Are there any other perspectives that you would like to add that would help students discover and learn grade level standards?

Two teachers did not answer this question and two shared, they thought the need to train the students better prior to having them use technology in the classroom was imperative. Two teachers stated all students should be able to use all technology all the time in both general and special education classes. One teacher, T1, thought that returning to basics would be the best idea. This would mean returning to memorizing all basic algorithms for mathematics and returning to just paper pencil requirements for all classrooms.

JQ 6: what have you learned from this process of working with students with learning deficits and technology?

Three teachers did not answer this question. Both of special education teachers stated they felt as though students need to be trained on how to use the technology effectively. T4 stated that after using technology in the classroom and the success she has had with students meeting expectation. She has learned that," many of her general education students probably have some sort of learning deficit or challenge, even if it is just mild, that can sometimes interfere with their learning and technology can offer support."

One teacher, T2, saw key areas that could be worked on with the general population students, because the students will have a difficult time interpreting the information from online. His special education students were not just grasping the information and work, but were excelling with the new format, whereas T1 wanted less technology throughout all subject areas. T10 wanted to share all lessons learned throughout the entire district.

Table 1

Summary of Categories From Reflective Journal Data Analysis

Journal Question	*Positive*	*Negative*
JQ1: Using technology	Access critical thinking	Does not access critical thinking
		Need Training
		Distracted
JQ2: Teacher Expectations	Same expectations	Lower expectations
	Higher expectations	
JQ3: Met/Exceed Expectations	Met expectations	Consistently failed
		Disappointed
JQ4: Anything Different	Accommodations	Self esteem
	Modify lessons	
JQ5: Additional suggestions	Training	Memorize basic info/skills
JQ6: Learned	Train students	less technology
	Meet grade level standards	
	Excelling new format (SPEDS)	
	Sharing information	

The findings were derived from the data related to the volunteer sample of the collected reflective journals, which included the research questions.

Surveys

The purpose for the survey was to gather teacher opinions regarding the use of technology that allowed students with working memory deficits to access critical and higher-order thinking skills while in STEM classrooms. Only five teachers answered the survey questions. The survey questions (SQ) were as follows:

SQ1: Can students, with working memory deficits while using assistive technology in the classroom for assignments and/or while taking tests assess critical or higher or thinking skills?

Three of the five teachers that responded the survey stated yes, they felt that technology gave students access to critical and higher order thinking by eliminating frustration, then access skills they may have normally been lacking, or give them an opportunity for success. T1 stated that although technology was encouraged, no difference for improvement has been seen in the classroom or on assessment. T3 found that if assignments and assessments appear too difficult students would shut down whether technology is used or not.

SQ2: What are your expectations for students with working memory deficits when they do have technical assistance to access higher order thinking skills?

Four of the five teachers stated that they had the same expectations for students with technology as they did without technology. They expected students to be and perform their best. Only one teacher stated that she had lower expectations for special education students.

SQ3: What are your expectations for students with working memory deficits that do not have technical assistance to higher order thinking skills?

Four of five teachers stated they had the same expectations for student success without technology as they would with technology. Only one teacher stated that she lowered her expectations for all special in students and all areas. One teacher stated that if students were not using technology, more processing time may be provided; students may struggle, asked for assistance, but need to be interested to be successful.

SQ4: What else would be beneficial in helping special education students with working memory deficits, while using assistive technology during classroom assignments and assessments to access critical or higher order thinking skills?

One teacher, T1, stated that she wasn't entirely sure that the technology would be helpful, because it can be a hindrance at many levels. T10 stated that using different learning styles such as think pair share, scaffolding, universal access, along with extra thinking time and the technology helps with their learning. T4 suggested using peer tutors to help with grade level curriculum and technology. T3 stated that there needed to be a change in the students' belief system. Students need to know they can be successful and to not shut down and give up. They need to understand, persevere, make mistakes, and to ultimately learn.

Table 2

Summary of Categories from Survey Data Analysis

Journal Question	*Positive*	*Negative*
SQ1: Using technology	Encourage	Not made a difference
	Access skills they are lacking	Shut down and not try
	True opportunity	
SQ2: With using technology	Same expectations	Different expectations
	Perform their best	Lower expectations
SQ3: Without Using technology	Same as when at technology	Lower expectations
	Ask for Assistance	Students to struggle
	Attempt to succeed	Ask for assistance
		Behavioral issues
SQ4: Other benefits	Self-esteem	Less technology (hindrance)
	Tutoring	Exercise memory
	Change belief	
	Work in Groups	

The findings were derived from the data related to the volunteer sample of the collected Survey open ended questions

Interview Questions

The purpose of the interview was to provide the participants with the opportunity to give an oral/verbal response to the interview questions as to their perception of technology use in the classroom and the impact it may have on students. Participants' interview response data follows:

IQ 1: What are your perceptions of students with working memory deficits using assistive technology during classroom assignments and or while taking tests to assess critical or higher order thinking skills?

Seven of the nine answered the question with the response of yes that technology can assist students with working memory deficits to access critical or higher-order thinking skills. One teacher stated no, that technology does not appear to assist students' access higher-order thinking skills. Another teacher stated that there appeared to be no difference with the students while using technology, the results were the same. Teachers T3, T4, T6, and T8 responded both yes and no. T3 and T4 both agreed that students shut down without the technology. T3 also stated yes to the same question, because of "student's feeling successful".

Six of the nine teachers stated that training with the technology for both teachers and students needs to be a requirement. T12 acknowledged "students should be taught how to efficiently and effectively use technology. Students need to be taught how to use a calculator and how to enter data correctly into a calculator."

IQ 2: When working with students having memory deficits, how are your expectations the same or different when students have technical assistance to access higher order thinking skills as compared to when they do not have technical assistance?

Seven of the nine teachers interviewed stated that their expectations would be the same in the classroom where the students did or did not use technology to complete either assignments or assessments in their classroom. Only one general education teacher, T6, stated that “she lowered her expectations for all special education students, whether they did or did not use technology. She did not have the same expectations for special education students as she did for her general education students. On the other hand, one special education teacher, T12, stated she “raised her expectations when students use technology.” These perspectives run parallel with the mindset of teachers and the use of technology in the classroom.

Table 3

Summary of Categories from Interview Question Data Analysis

Journal Question	*Positive*	*Negative*
JQ1: Using technology	Access critical thinking	Does not access critical thinking
		Need Training
		Distracted
JQ2: Teacher Expectations	Same expectations	Lower expectations
	Higher expectations	

The findings were derived from the data related to the volunteer sample of the collected reflective journals, which included the research questions.

Trustworthiness

I collected the information from the volunteer participants through open ended survey questions and reflective journals, to analyze data for the same phenomena, while keeping the school district, middle school, and the participants' identities confidential. I built a relationship with each participant ensuring that I was trustworthy. I believed that each STEM and special education teacher would be honest, when answering the survey questions and responding to the reflective journal questions. Each reflective journal and survey was returned to me upon completion by the participants within the timeframe allotted by the researcher. Each teacher/participant was given adequate time to answer survey questions and to reflect upon journal questions prior to returning either or both to the researcher.

Credibility

I compared the answers of the reflective journals and the responses to the surveys. Once the journals had been coded and reformatted, I asked participants to provide feedback on their individual surveys and journals to ensure that they were not misquoted or misrepresented. I asked members of my team with advanced degrees to scan the raw data and determine whether or not the findings are plausible based on the data.

Transferability

For this study, I used STEM teachers' perspectives on the use of technology and whether it helps special education students obtain critical or higher order thinking skills. I presented a detailed presentation of the setting and the findings of the study. I am also presenting a detailed presentation of common patterns that emerged during the review of the reflective journals and surveys.

Dependability

I crosschecked using multiple forms of data. I used the reflective journals and the surveys to find commonalities. I also used the strategy of peer review by asking colleagues with advanced degrees in education to review data concerning the use of technology in the classroom to access critical thinking skills and the findings of this study for their plausibility. I used the strategy of an audit trail by maintaining a journal noting how the data was collected and the decisions that were made throughout the research process.

Confirmability

Although I am a special education teacher, this position did not put me in a position to be a part of this research. As an educator, I want what is best for all students, and need to be mindful to keep an open mind, when determining the outcome of the research and insuring my personal biases did not skew the objectivity of the results. I ensured that I used the data that were presented in the answers provided in the reflective journal questions by the participants, as well as, answers provided for the survey questions.

Results

CCSS have a technology strand as noted by: California Common Core State Standards English Language Arts & Literacy in History/Social Studies, Science, and

Technical Subjects (http://www.cde.ca.gov/be/st/ss/documents/finalelaccssstandards.pdf) which this middle school is trying to implement. Keeping this in mind, Western Road Middle School has provided technology for every classroom which includes a Google Chromebook for every student. This is the first year they have attempted to cover the technology standard, by providing technology for all students. This school year's 2015 – 2016 seventh-grade students had prior experience with the Chromebooks as sixth grade students, since the sixth grade was the only grade level provided with technology throughout the entire grade level classrooms. The Grade 6 teachers, also, went to Google Chromebook training during the 2014 – 2015 school year. The majority of the Grade 7 and 8 teachers got their Chromebooks at the beginning of 2015 – 2016 school year and had very little training.

The responses to the reflective journal and surveys expressed the need for training for the teachers and for the students. One One of the special education teachers suggested students could learn more by participating in small group sessions, electives, or afterschool programs, this helps them learn technology; because for students to become successful at using technology in the classroom, they need to receive the training and there is no time in their present schedules with the all their core and remedial classes. General education teachers' frustration was evident, with the use of technology; due to the increase of time it takes for students to complete tasks. The teachers stated that the students could not get the voice to work with the text to speech application in order for the computer to read the passage or the questions and answers, which is an accommodations for many of the special education students that cannot read at grade-level nor was the voice loud enough for them to hear and understand what was being asked.

Results of Reflective Journals

Reflective Journal question number one: asked the teachers their perception of students with working memory deficits using technology in the classroom or during assessments?

There was a distinctive divide between the general and special education teachers' perception as to whether technology should be allowed to access critical or higher order thinking skills. The general education teachers stated that students tended to be more off task, tended to lose focus, use technology as a toy rather than a tool for learning. While the special education teachers, stated technology enhanced critical thinking founded essential for students, and students should be allowed to use assistive technology.

Reflective Journal question number two asked when working with students with memory deficits, how the teachers expectations where the same or different when students use assistive technology to access higher-order thinking skills as to when students do not have technical assistance?

All of the teachers but one stated they had the same expectations for all students general and special education only once math teacher stated that she had different expectations for special education students than she did for her general education students. Teachers stated that technology was a tool that leveled the learning field, and all students should be successful whether or not they have disabilities when given the accommodations and assistive technology, and the student should be at least be able to show a better understanding of material as technology reads the material allowed. It was also stated in no way a special education student that use technology as a support given an advantage, just as an athlete may require supports of legs or joints. These supports do not give the athlete an advantage, but support the area that may be weak.

Reflective Journal question three: asked did students meet or exceed the teachers' expectations?

One general education teacher stated they understood the difficulty that students have with being successful when they have a memory deficit, but it's not an excuse not to make an attempt to succeed. He stated that if a student was really interested in being successful with or without technology they would succeed. The research also showed that both general and special education teachers stated that their expectations were the same with students did or did not have access to technology, but some of the students required extra time, because they were unable to complete the work due to their inability to type, to manipulate some of the programs that they were required to use, or they were distracted and unfocused on the task, while using the technology as a toy. The other side, to this same question, was that students met the teachers' expectations for the task or the students neither met my expectations nor did they exceed them, when given more time to do so.

Reflective Journal question number four: Could you have done anything different and would you have done anything different?

CCSS requires schools to have and use technology. Teachers have made adjustments in their classrooms for students to use the assistive technology. T1 stated. "I cannot think of anything else that I could or would do differently. I would prefer to go back to less technology and reverse the trend that students are having less proficiency with less technology not more. Unfortunately students are not expected to memorize anything anymore; they don't know their own phone numbers or their friend's phone number. They don't memorize their address or even know how to get around their own town. They don't know money and they can't perform math in a store or restaurant. They can't tell time unless it's on a digital clock. I think we need to return to some of the basics and learn months of the year, days of the week, the seven continents, and the difference between a city, state, and country. This was lost during NCLB, when all that was taught was reading and math." Not all teachers responded in this frustration. T11 stated, "Historically throughout my teaching years, I have always allowed certain students tools to utilize for accessing higher-order thinking skills as compared to when they do not have technical assistance. I have always felt students with these deficits need support to access the curriculum." The results of this question is reflective of the mindset of the educator from the classroom

Reflective Journal question number five: asked are there any other perspectives that you would like to add that would help students discover and learn grade level standards?

There was a similar thread throughout all journal and that was training. In order for the technology to be effective for students and for the teachers the consensus was the need for proper training for academics rather than personal. Many students have technologies such as cell phones, tablets, and games that interact with televisions that are

Wi-Fi accessible. Students know how to go onto YouTube to find a game or a song that they want to play or hear. Students need to be taught how to proper use for academic research. T2 stated, "Students are unaware of how to find a website that is academically vetted for research materials such as university websites or other scholarly reputable websites. T10 stated, "Teachers need to teach students on the concepts of how to enter information not only into technology but also calculators. Without the basic knowledge or the order of operations they are ending the information they're going to get the wrong or incorrect answer." T12 stated, " Setting a student down with your phones or earbuds along with the computer that is used to listen to nothing but music loudly and expect students to listen and understand someone read a passage or concept and expect the same students to read obtain or understand what was just read without practice is not feasible." Lessons has to be taught. Prior to having technology reading academic information from the page, teachers or paraprofessionals would read the questions and answers to the student during assignments and assessments. These same teachers or paraprofessionals were in the classroom when these assignments were taught so during the assessment they would know how to use the tone of their voice the same way the teacher would use the tone of her voice to put emphasis on certain words when things were taught when they read the questions and answers. When these items are now read through text-to-speech application and is monotone with no type of emphasis on any word unlike how it was taught. This monotone causes the special education student not to pay attention because they have not been taught this way. This is an entirely new perspective of teaching. A student has to listen to what is being said and understand how to decode the monotone voice. Educators do not have monotone voices and it is very difficult for students with learning disabilities to understand this monotone and without natural hand gestures.

Reflective Journal question number six: what have you learned from this process of working with students with learning deficits and technology?

It was stated that students with deficits benefit from the use of technology and that technology is essential for students with deficits to access grade level curriculum. Teachers will be trained accordingly, and in turn train the students to use the technological tools for a greater educational success. This opportunity should begin at kindergarten and continue through high school.

Results of Survey Questions

Survey question number one: asked if students with working memory deficits while using assistive technology in the classroom on assignments and or while taking tests can access critical and higher-order thinking skills?

Two teachers stated they believed that students could access critical or higher-order thinking skills and could use technology to access skills that they are lacking. While the other two teachers stated they thought while using technology did not make much of a difference with test scores, it did not necessarily stop students from shutting down and not trying.

Survey question number two: asked Teachers' expectations for students with working memory deficits when they have technology to assist them to access higher order thinking skills?

The teachers stated that they had the same expectations whether they did or did not use technology and whether the students were or were not special education. Three teachers stated that they expected the students to perform their best. One teacher stated that while using technology she expected the students to go beyond calculations. Only one teacher stated that she had different expectations for special education, and those expectations were lower for the special education students than for the general education students.

Survey question number three: asked what were your expectations for students with memory deficits when they do not have technical assistance to higher order thinking skills?

Two teachers stated they wanted honest attempt to succeed. They do not expect perfection, but expected students to attempt While three teachers stated, the expectations were the same as when they had technology Another teacher, T4, stated that she expected the students to struggle, asked for assistance, and she expected the behavioral issues to be more than when they use technology.

Survey question number four: asked what else would benefit special education students working with memory deficits while using assistive technology in the classroom during assignments and assessments to access critical or higher order thinking skills?

All four of the teachers stated that training on/with the technology would benefit the teachers but also the students. There was a lack of training in both areas. One teacher stated that he felt the special education students were being told that they could not do certain things which put up a road block for the students to be successful. One of the final suggestions from T1 was that students should be made to exercise their memories more and take away much of the technology and go back to rote memorization. That would be a wonderful suggestion if it were not for the fact that the students' disability could be working memory deficit.

The theme most prevalent throughout the surveys, journals, and interviews was the frustration due to the training both teachers and students. This frustration with the lack of technology training was a concern, as stated by T12, "the student can learn by participating in an elective course, a small group session, an after school program or at lunch which will teach a review while reinforcing specific tools, websites, and other technology resources that teachers use in their classrooms. This allows students an opportunity to become more successful at using technology while in the classroom, due to prior or current training they have received." T1 and T2 found that it was an excellent format for special education students to learn to have success they both describe the need to train students better in the logging in process, how to adjust headsets and earphones, and what is and is not acceptable technology behavior.

Summary

The researcher was able to obtain STEM teachers perspectives that were students with working memory deficits were able to use technology as a conduit to higher-order thinking skills. After analyzing the results of the open ended survey questions and the reflective journals, the researcher was able to see that teachers' perceptions were both positive and negative toward technology use in the classroom. Suggestions made by the STEM teachers towards what they thought needed to be done to further promote or encourage the use of technology, for special education students in their classrooms, to encourage higher order thinking skills. Conversation, training, and continued effort among all those involved should/would only continue to improve students' academic involvement and learning were other suggestions made by both general and special education teachers. This will initiate and enact social change within the school culture. Chapter 5 connected these findings; summarize the study, formed conclusions, present recommendation for action.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this qualitative study was to explore the perceptions of Grade 7 and 8 special education teachers and STEM teachers' use of calculators and technology supporting special education students' basic need for help in calculations and as a conduit to learning higher order thinking skills. During my investigation I considered how students' performance with and without technology in the academic setting was perceived by general and special education teachers. The case study is "purposeful sample' (Patton, 2002, p. 230), along with in depth understanding from open ended survey questions and reflective journal reviews using real-life context of the contemporary phenomena.

This study began with a discussion about the purpose of the study. Then, an examination of the STEM and special education teachers' perception, while working with students with working memory deficits using assistive technology in the classroom for assignments and/or assessments. While accessing critical or higher-order thinking skills, students achieve grade-level success. I also outlined the specific research questions that would be the vehicle through which I would explore various relationships outlined in purpose. They include:

1. What are teachers' perceptions of students with working memory deficits using assistive technology during classroom assignments and/or while taking tests to assess critical or higher or thinking skills?

2. When working with students who have memory deficits, how are teachers expectations the same or different when students have technical assistance to access higher order thinking skills as compared with when students do not have technical assistance?

Interpretation of findings

The reflective journal and the survey questions contained the research questions that were designed to be asked in the face-to-face interview, but the questions were also designed to allow the participants' time to reflect upon answers that they may have provided either during the earlier conversation or for an earlier questionnaire. Participants' responses to the survey, reflective journal, and interview questions appear to have positive and negative response/results. The following is an analysis of the data as it relates to each of the research questions.

1. What are teachers' perceptions of students with working memory deficits using assistive technology during classroom assignments and/or while taking tests to assess critical or higher or thinking skills?

Nine of the nine STEM and special education teachers use technology in their classroom. Five out of the nine stated that technology has made a difference and students perform their best on assessments, due to improved access to skills that they are lacking, and it adds support/assist students with memory deficits. The other four teachers stated that technology did not make a difference; technology became a toy, while students lost focus and became more distracted and off task.

2. When working with students who have memory deficits, how are teachers expectations the same or different when students have technical assistance to access higher order thinking skills as compared with when students do not have technical assistance?

Seven of the nine teachers stated they had the same expectations with or without technology. They expected the students to perform their best while attempting to succeed. Only one teacher (T6) stated, “My expectations are still lower than for special education students, but higher than if they were not using technology. That is also due to how I use the technology to help lead them. My expectations are lower than it is for the rest of my students.” According to Dweck, (2008) “educators think that lowering their standards will give students success and raise their achievement. It doesn’t work. Lowering standards just leads to poorly educated students who feel entitled to easy work and lavish praise” (2008, p. 193.). Although eight teachers stated that their expectations were the same for all students, the fixed mindset of this one could undermine the education of special education students each day.

Teacher (T1) stated in the reflective journal:

> I really think we need to return to basics and yes, memorize a lot of the foundation or basic information and skills. I think with all the technology available, cell phones, laptops, chromebook’s and Internet research engines that our students are becoming ‘dumber’. They are not expected to remember anything. I realize that everyone has a different memory

> capacity and I do not believe that everyone can or should be held to the same standard, but I think they should be expected to exercise that muscle.

According to Sousa, (2008) “the human brain is a five star pattern organizer where one thought triggers another in the long term memory. Associative memory is powerful and allows one to make connections of fragmented data. Associative memory runs into problems in the areas like multiplication tables, where various pieces of information must be kept for interfering with each other. It can apply knowledge learned in one situation to another situation. Students remember tables through language, causing different entries to interfere with one another.” (2008, pp. 42 – 43). Mathematical facts are arbitrary but also intertwined linguistically and for students with a working memory deficit, when a multiplication task requires the brain to do multiplication with precise calculations this may signal the retrieval of information but it is not always be possible from long-term memory.

Frustration from lack of training, for the entire staff prior to this year’s commitment to technology, penetrated the answers given by the STEM and special education teachers. There appeared to be no resentments toward having special education students in the general education neither class, nor did there appear to be resentment for having to follow IEPs and use accommodations. Special education students were being taught along with their neurotypical peers.

Limitation of study

Limitations of this study were that out of all teachers and all subject areas; only Grade 7 and 8 science and mathematics teachers were asked to participate. A total of 13 participation letters were sent for signatures. Ten applications were returned with signatures. Reflective journals were sent once the researcher received the signature page. From the ten surveys and reflective journals sent to the participants, nine were filled out and returned in their entirety. Two Grade 7 math teachers and a special education teacher declined to participate. The participants were: three Grades 7 and 8 general education math teachers, two Grades 7 and two Grades 8 science teachers, and 2 special education teachers. Sixth grade teachers were excluded, as were teachers within the sub groups of ELA, Social Science, and English Language Development.

While the small sample size afforded me the opportunity to collect in-depth and comprehensive data on each teacher's expectation and perception, the ability to make a generalized claim of the results of the study are not possible. The results obtained from this study, while of great value, apply to this group, at this time, and at this particular school with these particular teachers. The small sample sizes made the use of percentages to describe the qualitative data and were appropriate to use at this time.

Recommendations

The purpose of this qualitative case study was to explore the perceptions of the Grades 7 and 8 STEM teachers and the use of a calculator or supportive technology by special education students for the basic mathematical calculations as a conduit for learning higher order thinking skills. Limited research is available, for STEM teachers' perspective on the use of calculators and other technology, while assessing students for critical thinking skills. As this research did not provide a definitive perspective on how calculator or technology use did or did not lead to critical or higher-order thinking skills other possibilities for research is recommended. Such as including ELA, Social Science, and English Language Development teachers as part of the teachers' perspective survey to obtain a wider perspective for curriculum involvement. .

Also, once this school has had time to use the Chromebook technology for two to three years, revisit/reevaluation with the STEM teachers and determine if their perceptions have changed or if they are the same.

Implications

This study is relevant for social change with school administrators, teachers, and those individuals interested in ensuring that students with disabilities are provided with free and appropriate education at the middle school level. The results, five of the nine teachers stated that technology has made a difference and students do their best on assessments, due to improved access they have skills that they are lacking and it adds support/assists students with memory deficits. The other four teachers stated technology did not make a difference; technology became a toy, while students lost focus and became distracted and off task. The teachers also stated they were frustrated with the time it took having to teach students to log into applications and classrooms over and over. This took time assessments and learning. This also fueled the frustration of the teachers. Furthermore, some STEM teachers thought that the technology was going to be the panacea for failing students. Instead it appears to be the one thing that helps students lose focus be venturing to you tube, chat, or email instead of the academic setting they need to be on.

Once fully trained on the new technology, the teachers feel they can have a better grasp on how to use technology in their classroom, while helping students maintain focus, when using technology applications. This training on the use of technology will have the greatest impact on special education students. If success is achieved by using a technology accommodation, this accommodation can be implemented in all classes through the IEP process and special education students can achieve a success in all academic areas by using technology.

Conclusion

The middle school has and continues to go through changes due to the Federal and California State mandates for the Common Core requirements. Teachers are going to standards training. According to the math teachers, which include the special education math teachers, this is their fourth year of ongoing training with the College Preparatory Math (CPM) curriculum. The school received chromebooks and carts for every student and class, but the extensive training was not given to every teacher. Not all teachers are technology savvy. They can use the programs that they use every day or the ones they have used for years but not the new Google technology given to them.

The frustration of not being prepared for this new technology came across in the responses the STEM teachers gave to the survey questions and also the reflective journals. They stated that training was needed for themselves and also the students. They were not pleased with what T2 called, “learning by fire.” They were very frustrated with the time it took having to teach students how to log into applications and classrooms over and over. This took time from assessments and learning. This also fueled the frustration of the teachers.

Some STEM teachers thought that the technology was going to be the panacea for failing students. Instead it appeared to be the one thing that helps students lose focus by venturing to you tube, chat, or email instead of the academic setting they need to be on. For the students that have difficulty reading, the Chromebook has a setting that reads for them. The school provided earbuds for every student. Although they aren't the latest style, they are functional.

Very little was stated about the use of the calculator, because of the frustration brought on this year by the use of technology. Two math teachers stated that the use of a calculator needed to be preceded by training the student with the proper use and functions of the calculator. Although, one science teacher and one math stated that they thought that the calculator did help in the discovery of mathematics which leads to higher order-thinking skills. There was no divide between general and special education teachers' perceptions.

Only one teacher stated that the expectations/requirements for the classroom are different for special education students and general education students. The special education teachers stated that they had the same expectations, while using the same grade-level curriculum as the general education teachers and using the same assessments as the general education classes. The only difference was that the special education classes did not stay as close to the pacing calendar as they would like. The special education class pace was a little slower than the general education classes, but everything else was the same. The IEP accommodations were followed in both the general and special education classes and expectations were for all students to succeed. This grade-level success included the teacher that had lower expectations for special education students than for her general education students. According to this teacher, she has the lower math students and expects her special education students to keep up with her lowest students when using their IEP accommodations for success. She continued to have high grade level expectations for all students.

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Appendix A: Open Ended Questions

Question 1: What is your perception of students with working memory deficits using assistive technology during classroom assignments and/or while taking tests to access critical or higher order thinking skills?

Question2: What are your expectations for students with working memory deficits when they do technical assistance to access higher order thinking skills?

Question 3: What are your expectations for students with working memory deficits when they do not have technical assistance to higher order thinking skills?

Question 4: What else would you like to share, that would be beneficial in helping special education students with working memory deficits while using assistive technology during classroom assignments and assessments to access critical or higher order thinking skills?

Appendix B: Survey Instrument

Thank you for participating in this study. Survey should be returned no later than ___________________. The purpose of this survey is to gather teacher opinions regarding the use of technology allowing students with working memory deficits to access critical or higher order thinking skills in a STEMs classroom.
Please fill out one survey per STEM teacher. If you prefer to break the survey down per period, you may use the back of the paper to do so. Thank you for your participation

1. Students with working memory deficits while using assistive technology in the classroom for assignments and/or while taking tests can access critical or higher order thinking skills?

____

____

2. What are your expectations for students with working memory deficits when they do have technical assistance to access higher order thinking skills?

____

____

3. What are your expectations for students with working memory deficits when they do not have technical assistance to higher order thinking skills?

____

____

What else would be beneficial in helping special education students with working memory deficits while using assistive technology during classroom assignments and assessments to access critical or higher order thinking skills?

____

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Appendix C: Reflective Journal

Date:

Journal	Observation
Question 1: What are your perceptions of students with working memory deficits using assistive technology during classroom assignments and/or while taking tests to access critical or higher order thinking skills? Suggestion: while using technology (i.e. calculators, tablets, and computers) do students appear to be more engaged or more receptive to the learning process? Does it appear that student's no longer shutdown because they are unable to do the calculations? These are just suggestions to keep in mind as you meander through your classroom throughout the day. Question 2: When working with	.

students having memory deficits, how are your expectations the same or different when students have technical assistance to access higher order thinking skills as compared to when students do not have technical assistance? Suggestion: does technology appear to enhance or hinder the learning process or does it enable students with learning disabilities to discover higher order thinking skills? Does technology level the learning field? Question 3: Did students meet or exceed your expectations? Question 4: Could you have done anything different and will you do anything different? Question 5: Are there any other perspectives that you would like to add that	

would help students discover and learn grade level standards? Question 6: What have you learned from this process of working with students with learning deficits and technology I appreciate any and all of your thoughts. Thank you.	

Attachment D: District Letter

August 1, 2015

Walden University
Attn: Dr. Barry Birnbaum
100 Washington Avenue South, Ste. 900
Minneapolis, MN 55401

Re: Wanda Patrick, PhD Candidate

Dear Dr. Birnbaum and Distinguished Faculty of Walden University,

The purpose of this letter is to confirm authorization of the study that is being conducted by Wanda Patrick, a PhD candidate at the Walden University.

I am intrigued and excited about Ms. Patrick's study described as a qualitative case study to explore the perceptions of STEM teachers in grades seven and eight regarding the use of a calculator or other supportive technology by special education students for basic mathematical calculations as a conduit to learning higher order thinking.

As Superintendent of the Weaver Union School District, I am authorizing the teachers in the Weaver Union School District to participate in the following activities:

1. Participation in taped interview(s)
2. Participation in a survey
3. Approval of the transcribed interview notes

Please feel free to contact me should you have any questions.