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Perceptions of Teachers on Instructing Remedial Mathematics Students

Christy Leigh DeFilippis
Walden University

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2014

Abstract

Perceptions of Teachers on Instructing Remedial Mathematics Students

by

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MA, Nova Southeastern University, 2001

BS, University of Maryland, 1993

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Education

Walden University

December 2014

Abstract

Approximately 12% of students at the study middle school failed to reach proficient levels on state assessments in mathematics from 2010-2012. Poor performance on assessments can limit future mathematical trajectories and opportunities for students. One of the causes for failing to meet proficient levels on mathematics assessments could be the inconsistent use of teaching practices targeted at supporting lower achieving students; according to such reasoning, a consistent use of research-supported practices could result in improved student performance. Kolb's experiential learning theory, Vygotsky's social development theory, and Maslow's motivation theory provided a framework for this case study. Interviews and observational data were used to ascertain 5 teachers' perceptions concerning instruction for students who fail to reach proficient levels on state assessments. Research questions examined teachers' perceptions regarding implementing best instructional practices and regarding number sense, computational, problem-solving, working memory, and self-efficacy needs of lower level basic skills students. Data from 10 teacher interviews and 15 observations were analyzed using typological coding and thematic analysis. Results indicated that teachers perceived that homogenous groupings prevented teachers from meeting needs of students scoring below the proficient level and from using research-based strategies. The resulting position paper outlines the recommendation to de-track mathematics classrooms into heterogeneous groupings. Study results can be used to help provide teachers with research-based strategies targeted toward improving instruction for basic skills students.

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Dedication

I dedicate my work to my family, friends, and professional colleagues. They helped me through this process through their ongoing support. For helping me maintain the daily routines of life, work through obstacles in my coursework, edit my papers, and overcome moments of doubt, I am truly grateful. I am also thankful for all the times my family sacrificed what they needed so that my work could get done. I appreciate it all, and I love my family for their willingness to support my efforts. I am fortunate to have a great core of people to share life with. Mom, Rob, Michele, Tommy, Katelin, Connor, Boston, Leo, and Lily, I could not have done this without you. Therefore, this project study is a result of our shared journey.

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This doctoral journey has challenged me beyond limits I never imagined I could pass. The process of researching, analyzing data, and writing in a scholarly voice took me out of my comfort zone. If I knew ahead of time all the factors that this journey entailed, I would have never believed I could handle it. I guess the saying is true that God never gives you more than you can handle because I did persevere through this difficult journey even through times of tremendous doubt when I would tell my mom that I had no idea how to do the next step. God granted me with two gifts to help me through this journey, exceptional determination and an extensive support system.

Thank you to the teachers at my school of study, family, friends, running, and ice cream for motivating and assisting me during this doctoral journey. Thank you to my committee for their guidance, expertise, and criticism along the way; this study was a challenging task that brought sleepless nights and self-doubt. With the support of this network of people, I was able to persevere. Thank you for believing in me when I did not believe in myself.

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Section 1: The Problem

Introduction

Twelve percent of sixth grade students at a New Jersey middle school did not perform at grade level in mathematics in 2012, as the students failed to reach the proficient level on the New Jersey Assessment of Skills and Knowledge (NJ ASK), which is a measure of grade-level efficiency. Factors that may contribute to this problem include difficulties with number sense, working memory, problem-solving, computation, and self-efficacy. Bottge, Rueda, Grant, Stephens, and Laroque (2010) noted that as students advance to middle school and high school, growth in computational skills slows or stops altogether due to poor computational fluency. Students need to demonstrate proficient computational fluency to successfully solve operational problems on the NJ ASK; therefore, middle school teachers need to address the mathematical deficiencies of basic skills students. Researchers found several factors that define middle schools, which might perpetuate poor mathematics performance. The middle school developmental period, which is characterized by changes in the intellectual, social, and emotional needs of students, may result in increased trajectory differences, lower grades, higher anxiety levels, and reduced levels of motivation and self-efficacy for students (Barber & Olsen, 2004; Grills-Taquechel, Norton, & Ollendich, 2010; Juvonen, Le, Kaganoff, Augustine, & Constant, 2004; Moss & Honkomp, 2011). Trajectory differences refer to the mathematical courses students take as a result of past success in mathematics. Mathematics performance often determines which students enroll in higher level courses. The higher performing students enroll in the advanced mathematics courses. The

negative outcomes that can characterize the middle school years potentially jeopardize students' chances of success in high school, college, and life because lower track students might be exposed to less challenging mathematics curriculum and as a result have fewer job opportunities later in life (Carolan, Weiss, & Matthews, 2013).

Researchers also found that instructional quality accounts for a large percentage of differences in mathematics achievement scores (Levpuscek & Zupancic, 2009; Slavin, Lake, & Groff, 2009; White, 2009). Research conducted by the This We Believe organization indicated that middle school students with higher test scores more likely received student-centered instruction than lecture-based instruction (McEwin & Greene, 2010). McEwin and Greene (2010) determined that teachers in highly effective schools implemented cooperative, inquiry, and online learning on a regular basis as opposed to using lecture-based instruction regularly. The reform efforts suggested by the This We Believe organization supported an emphasis on teaching for understanding through problem-solving experiences and student-centered learning activities; however, the study indicated that many mathematics teachers still rely solely on traditional teacher-based practices that were determined to be less effective among middle school students (McEwin & Greene, 2010). Many teachers still present information in only one way when, in fact, students possess unique intelligences defined by individual strengths and weaknesses (Gardner, 2006), which might be related to the underachievement of sixth grade students on the NJ ASK. Each student portrays a unique developmental trajectory, which implies the need to move beyond one-size fits all instruction to individualized teaching (Gardner, 2006). McEwin and Greene's results indicated that effective middle

schools implemented multiple instructional strategies including teacher and student-centered activities during mathematics instruction.

The results of the 2012 NJ ASK data indicated that the New Jersey middle school under study failed to meet the academic needs of certain student populations. The demographic profile indicated that about 54% of special education, 42% of English language learners, 4% of general education, 22% of African American, and 14% of Hispanic students scored below the proficient level in mathematics. The New Jersey Department of Education (NJDOE, 2012) designates ineffective schools as focus schools when learning gaps appear in testing data. The NJDOE identified the middle school as a focus school as a result of underachievement in subgroups such as the 4% of general education students who make up the basic skills student population. The middle school administration and teachers need to reflect on and improve instruction to meet state mandates, help students achieve proficiency levels, and increase student opportunities in life, a necessity that propelled this study. Better mathematics instruction for remedial students can help the middle school improve student performance of struggling students, meet student growth objectives, and move beyond the focus school status.

Definition of the Problem

Mathematics performance at the middle school is measured by two standardized assessments. The students take the NJ ASK administered by the NJDOE at the end of each school year. The NJ ASK measures progress students make toward mastering the knowledge and skills needed to pass the 11th grade High School Proficiency Assessment, which is required for graduation. Test questions from the NJ ASK align with the

Common Core State Standards (CCSS) developed by the National Governors' Association (NGA) and Commissioners Council of Chief State School Officers (CCSSO). The CCSS define what skills and knowledge students should know to graduate and be successful in college or workforce programs (Common Core State Standard Initiative, 2012a). Educators use the NJ ASK results to identify students who need additional instructional support to master the CCSS (Common Core State Standard Initiative, 2012a). The middle school also administers the LinkIt Benchmark Assessment quarterly. The middle school uses LinkIt as a formative assessment tool to measure student progress toward the mathematics curriculum. LinkIt provides teachers with immediate student results so that teachers can target problematic areas and implement intervention strategies (LinkIt, 2012).

A portion of the student population in the suburban New Jersey middle school continues to underachieve on the NJ ASK and LinkIt mathematics performance assessments in spite of intervention programs. A trend analysis indicated that the percentage of students scoring below the proficient level has been inconsistent in the past 3 years, ranging from 17% in 2009, to 27% in 2010, and back down to 12% in 2012 (NJDOE, 2012). According to the NJDOE (2008), "Sixth grade students performing at the partially proficient performance level in mathematics demonstrate limited evidence of and/or an inability to communicate conceptual understanding of procedural and analytical skills" (para. 1). The NJDOE (2013b), however, requires students to demonstrate adequate yearly progress in student performance so that students acquire the mathematic procedural and critical thinking skills needed to succeed in the 21st century work place.

The recent testing data indicated that 12% of the student population performed at the partially proficient level. The figure included 54 special education, three ELL, 33 general education, and 17 economically disadvantaged students. Some of the economically disadvantaged students were also labeled as special education, ELL, and general education students. The No Child Left Behind (NCLB) legislation (U.S. Department of Education, 2001) required teachers to implement intervention programs for marginalized groups such as learning disabled or ELL students. The middle school personnel developed programs to meet the needs of special education and ELL students to comply with the NCLB legislation. The remaining students scoring below the proficient level consisted of economically disadvantaged and general education students who make up the basic skills population at the middle school; therefore, 33 general education students were identified as the 2012-2013 basic skills population (see Table 1).

Table 1

Demographic Characteristics for the Students Scoring Partially Proficient on NJ ASK

Demographic subgroups	Total number of partially proficient students
Special education	54
English as a second language	3
Economically disadvantaged	17
General education	33

The state of New Jersey does not identify the basic skills population as a demographic group in the NJ ASK performance analysis report; therefore, the continuous underachievement of basic skills students can go unnoticed. Thirty-three students were enrolled in the basic skills program for the 2011 school year. A school level analysis, however, from the 2011-2012 school year indicated that roughly 33.3% of the basic skills student population failed to achieve the proficient level on the 2012 NJ ASK in mathematics (mathematics supervisor, personal communications, October 10, 2012). The 33.3% of basic skills students, as a result, continued to need basic mathematics skills remedial services and remained in the program for the 2012-2013 school year in spite of the fact that the basic skills intervention program was designed to exit students from the program. The middle school mathematics supervisor revealed that roughly 53% of the basic skills mathematics population also scored at the partially proficient level on the NJ ASK in Language Arts and also required basic skills services in reading and language. The data analysis revealed that a significant number of the basic skills mathematics student population scored in the partially proficient category in mathematics, reading, and writing content areas continuously.

The school examined in this study exhibited little racial/ethnic diversity; 82.9% of the population was identified as White in 2012 (NJDOE, 2012). The remaining ethnic make-up of the student population was 2.8% African American, 4.5% Hispanic, 8.6% Asian, 0.3% Pacific Islander, and 0.9% Mixed Race (NJDOE, 2012). Only 8% of the total student population was identified as economically disadvantaged (NJDOE, 2012). The majority of the basic skills mathematics population consisted of middle- to upper-

class White students based on the socioeconomic status data. The data indicated that only 27% of the basic skills population received free or reduced lunch and that 92% of the basic skills population was White (mathematics supervisor, personal communication, October 10, 2012).

The school district has created specific expectations for the mathematics program at the middle school under study. The general mathematics and basic skills programs at the school under study are intended to meet the needs of the students in order to meet state-mandated student growth objectives. The teachers are responsible for providing instruction that creates an optimal learning experience to enable students to make adequate progress towards student growth objectives, which will be assessed by NJ ASK and will factor into the new teacher accountability systems used to determine teacher effectiveness and tenure (NJDOE, 2013a). The mission statement at the school under study specifies that mathematics instruction should be tailored to meet individual needs, use authentic problem solving experiences, and be differentiated to meet all students' needs (mathematics supervisor, personal communication, October 10, 2014). If teachers at the school under study follow the trend and solely rely on teacher-directed instruction as identified by McEwin and Greene (2010), then the teachers instructional delivery could violate the school mission statement and could be related to the underachievement of the basic skills students.

Mathematics underachievement is also a concern for people outside education. At the turn of the century, politicians became concerned about the mathematics ability of American students due to a decline in ranking on international tests (Hammond, 2010).

In 2011, The National Center for Education Statistics (2011) and the *Trends in International Mathematics and Science Study* (TIMSS, 2011) reported that eight countries outperformed American fourth grade students and 11 countries outperformed American eighth grade students on the *Trends in International Mathematics and Science Study* (TIMSS). The results of the assessments also provided information to support the concern about the reoccurring pattern of underachievement. The TIMSS creators categorizes performance as advanced, high, intermediate, and low based on benchmark numbers as a means for interpreting the scaled score results (TIMSS, 2011). The assessment creators designed equal benchmark intervals. In 2011, 19% of the fourth grade and 32% of the eighth grade American students who took the international assessment scored in the bottom performance categories. The low performance percentages changed very little from the 2007 results, indicating that although different students took the test in the two years, the same proportion of students scored in the lowest performance category; therefore, the same percentage of students scored in the low functioning category year after year (National Center for Education Statistics, 2011). A comparison between the number of fourth grade and eighth grade students scoring in the bottom performance levels on the international assessment indicated that 12% more students scored at the low performance level in eighth grade than in fourth grade, which created a concern in that more students fell behind international standards at the middle school level (National Center for Education Statistics, 2011).

Based on the New Jersey state and international assessment data, a problem exists in that a portion of American students continue to underachieve in mathematics both at

the middle school under study and in schools across the nation. The evidence from the NJ ASK data, teacher opinion data, and research results indicates that causes of the underachievement may relate to student deficiencies in key mathematical concepts and teacher deficiencies in instructional methods.

Rationale

Evidence of the Problem at the Local Level

The NJDOE requires sixth grade students at the selected middle school to take the NJ ASK to assess students' level of understanding of knowledge and skills outlined in the CCSS. Performance on the NJ ASK determines student placement into leveled mathematics classes and enrollment into remedial or enrichment programs. High performing students follow the fast track and take algebra and calculus courses in preparation for college, and remedial students take general education courses. In other words, performance on the NJ ASK determines the mathematics trajectory of students and may influence students' decisions to pursue future mathematical opportunities because lower tracks may lead to less opportunity for students (Brunello & Checchi, 2007). Some researchers indicate that tracking students according to performance may perpetuate achievement issues for struggling mathematics students (Hanushek & Woismann, 2006).

Carolan et al. (2013) analyzed data from the Early Childhood Longitudinal Study to examine how the different middle school configurations affect student achievement. Carolan et al. described the middle school years as a time of negative outcomes for lower tracked students based on the fact that lower tracked students often demonstrate a decline

in mathematics grades, an increase in behavior issues, and a rise in trajectory differences among students. Carolan et al. found that the quality of instruction and student-teacher relationship predicted achievement more than the middle school configuration. Sixth grade students benefitted from strong instruction, emotional support, motivational climate, and positive teacher beliefs. Sixth grade is a pivotal time in the educational path of students, especially for struggling mathematics students, so educators need to provide sixth graders with differentiated instruction and positive classroom environments (Carolan et al., 2013).

The state of New Jersey identified the selected middle school as a focus school for the 2012-2014 school years based on the partially proficient performance of special education students in language arts and mathematics. Basic skills students also performed at the partially proficient level as measured by the NJ ASK. The NJDOE (2013) requires schools to meet academic achievement and student growth target goals from year-to-year. Basic skills students, who by definition score in the partially proficient category, will need to improve performance to meet student growth objectives defined by the state of New Jersey. The mathematics CCSS (2012) state that students must apply mathematical practices to persevere at problem-solving, reason abstractly, construct viable arguments, and attend to precision when solving problems. Researchers and teachers have noted that these areas are problematic for basic skills students. Researchers have indicated that differentiated instruction where teachers use summative and formative assessment results to drive instruction resulted in positive student gains for all demographic groups in mathematics (Beecher & Sweeny, 2008). Beecher and

Sweeny (2008) described differentiated instruction as a method of developing instruction based on student needs, interests, and learning styles. Tomlinson (1999) further explained that when teachers use differentiated instruction methods teachers need to understand the similarities and differences among the students and design multiple options for students to learn based on the commonalities and differences. Teachers need to advance basic skills students to the proficient level in mathematics by moving beyond traditional lecture-based instruction to implement an individualized approach to instruction where teachers apply best practices to meet students' needs.

Evidence of the Problem From the Professional Literature

Researchers link several factors to mathematics achievement for all students. Primary factors affecting math achievement relate to student capabilities and secondary factors relate to nonacademic, background, academic, and instructional environment variables (Zhao, Valcke, Desoete, Verhaeghe, & Xu, 2011). Zhao et al. (2011) suggested that teachers should design mathematics interventions for struggling students to address secondary factors because primary factors are difficult to influence.

Nonacademic variables that affect mathematics performance for struggling students are related to psychological factors such as motivation, self-efficacy, and engagement (Zhao et al., 2011). Researchers have demonstrated that learning experiences that allow students to develop psychological attributes such as motivation, self-efficacy, self-esteem, and affirmation are associated with increased mathematics performance (Ayotola & Adedeji, 2009). The findings relate to Maslow's theory (1943) that students are motivated by the most pressing basic needs, which include

psychological factors. An administrator at the school of study stated that teachers of basic skills students claimed that most struggling mathematics students experience issues with psychological factors (mathematics supervisor, personal communication, October 10, 2012), so teacher instructional methods to address self-efficacy are addressed in the study's research questions as self-efficacy relates to the mathematics performance of basic skills students.

Academic variables that affect mathematics performance are related to how teachers instruct student acquisition of content such as computational knowledge. Researchers demonstrated that struggling mathematics students have difficulty in developing fluency in basic computation (Berg & Hutchinson, 2010). Weaknesses in mental arithmetic negatively affect the development of higher level mathematics skills needed to be successful in mathematics (Lee, Ng, Bull, Pe, & Ho, 2011). Berg and Hutchinson (2010) found that poor working memory accounted for part of struggling students' inability to accurately compute because struggling students failed to hold information in their working memory while completing the computational process. Teacher instructional strategies for computational and working memory concepts are addressed in the study's research questions as computation and working memory relate to mathematics performance of basic skills students.

The middle school teachers identified problem-solving abilities as a major obstacle for basic skills students. Researchers have found that struggling mathematics students demonstrated weaknesses in problem-solving because students possessed deficiencies in identifying relevant information and self-monitoring (Kajamies, Vauras,

& Kinnunen, 2010). The CCSS used to assess mathematical performance states that students need to use problem-solving abilities to develop a deep conceptual understanding of mathematical concepts, identify multiple solutions to a problem, and justify answers (NJDOE, 2013a). Students need to establish effective problem-solving skills to attain a level of proficiency in mathematics courses. Teachers' instructional strategies for problem-solving concepts are addressed in the study's research questions as problem-solving relates to mathematics performance of basic skills students.

Researchers have also found that students who struggle in mathematics experience issues with number sense concepts (Geary, Bailey, & Hoard, 2009). Number sense refers to an "implicit understanding of the absolute and relative magnitude of sets of numbers, objects, and symbols that represent numbers" (Geary et al., 2009, p. 266). Courey, Balogh, Siker, and Paik (2012) found that fractional concepts were difficult for low achievers because students needed a sense of fraction size to understand fractions, but low achieving students lacked the ability to apply the part whole relationship. Courey et al. explained that fraction number sense issues were problematic for students even at the high school level. The students needed to develop number sense skills to estimate and round, relate percent, decimals, fractions, and measurement units, and understand place value relationships. Teachers' instructional strategies for number sense concepts are addressed in the study's research questions as number sense relates to mathematics performance of basic skills students.

Instructional factors related to student performance include teachers' background knowledge in the subject, inclusion of research proven instructional strategies, and ability

to plan effectively (McEwin & Greene, 2010). Slavin, Lake, and Groff (2009) conducted a meta-analysis of 100 studies to examine the effects of various mathematical programs on achievement outcomes from middle and high school students. The results of the study indicated that instructional quality improved student performance more than program content or textbook designs. The mathematics programs that implemented specific teacher instructional practices such as cooperative learning resulted in positive effect sizes for all populations of students ($ES = +0.42$).

McEwin and Greene (2010) found that certain instructional strategies resulted in more positive increases in performance for middle school students than other strategies. The researchers compared survey results of the control group schools, schools recognized as effective schools by National Forum to Accelerate Middle School Grades Reform or National Association of Secondary School Principals (NASSP), and random group schools. The organizations both have the goal of preparing adolescent students with the skills needed for postsecondary success (NASSP, 2014; National Forum to Accelerate Middle School Grades Reform, 2014). The National Forum to Accelerate Middle School Grades Reform (2014) has the goal of making every middle school academically successful by promoting best practices and effective policies while NASSP's (2014) goal is to improve high school and middle school leadership through professional development. The effective schools received the effective school status due to the high performance levels of students and staff measured by a set of criteria designed by the two organizations. The comparison revealed that effective middle school teachers used direct instruction 10% less and incorporated cooperative learning 20% more and inquiry

learning 14% more than the random schools teachers who did not obtain the high performance status (McEwin & Greene, 2010). The study also found that teacher quality related to teacher preparedness. Twenty-two percent more teachers in the effective school group possessed middle school certification than in the random group. The fact that New Jersey deemed the middle school of study a focus school in need of improvement demonstrated that the middle school failed to achieve a highly effective level and may indicate a potential gap between teacher practices at the middle school, and research-supported best instructional practices displayed by highly effective schools for basic skills students. During professional learning community meetings, the teachers at the school of study have discussed which instructional practices teachers are implementing during mathematics instruction. The discussions revealed that teachers spend the majority of mathematics instruction in teacher-centered activities (mathematics teachers, personal communication, October 10, 2012).

The assessment data and empirical research results provided information to illuminate the issue of low mathematics performance for middle school students including the middle school of study. Struggling mathematics students at the middle school and in the larger population possessed deficiencies in core areas such as number sense, computation, working memory, problem-solving, and self-efficacy. The data also indicated that teachers may possess deficiencies in instructional quality, which may impact the performance of basic skills mathematics students. The deficiency areas as well as challenges teachers face when working with basic skills students are introduced in

the problem statement, addressed in the research questions, and explained in the literature review.

The purpose of the qualitative study, therefore, was to investigate how select sixth grade teachers at a New Jersey middle school describe the teaching of mathematics to remedial students, known as basic skills students in the school under study. NJ ASK data analysis reports have indicated many factors that prevent basic skills students from succeeding in mathematics such as lack of mathematics skills in computation, procedures, and problem-solving (NJDOE, 2012). This We Believe, an organization that has examined the instructional methods of the most effective middle schools, described effective mathematics programs as having challenging, exploratory, integrative, and relevant curriculums that incorporate the instructional strategies of cooperative learning, inquiry, and student-centered learning (National Middle School Association, 2003). Beecher and Sweeny (2008) found that enrichment activities that required students to solve integrated, real-life problems, and differentiated lesson plans resulted in reducing the number of students that scored in the remedial level on standardized tests by 28% in reading and mathematics. This We Believe and Beecher and Sweeny's suggested incorporating research-based practices in identified problematic areas for basic skills students, such as problem-solving; therefore, in this study I aimed to understand mathematics teachers' perceptions about incorporating student-centered, differentiated, real-life instruction during mathematical lessons for basic skills students.

Even with the positive evidence to support the use of the best practices outlined in the literature, teachers often resort to using only the familiar practice of direct or explicit

instruction to teach mathematics to all students instead of incorporating other sound instructional methods to meet the varying needs of students (McEwin & Greene, 2010). Bottge, Grant, Stephens, and Rueda (2010) found that students benefitted from explicit and student-centered types of instruction as both the explicit and student-centered study groups demonstrated increases from pretest to posttest on the mathematics assessment. Bottge et al. suggested that educators should consider using a blend of embedded and explicit techniques so that struggling mathematics students can integrate and practice mathematical understanding of concepts in multiple ways. Poncy, McCallum, and Schmitt (2010) described explicit instruction as an instructional strategy where teachers present concepts in a systematic way using prescribed guided and independent practice and corrective feedback. Khan (2011) pointed out a problem with current teacher use of explicit instruction in that many teachers spend 95% of their instructional time lecturing, leaving only 5% of class time for providing the student feedback essential for the success of explicit instruction. Research regarding teachers' perceptions about how teachers currently teach mathematics, therefore, will provide local and state mathematics educators with information related to gaps between teachers' perceptions about how teachers teach mathematics and possible best practices for basic skills students, which may contribute to remedies for mathematics-related learning issues associated with poor computation, number sense, problem-solving skills, and self-efficacy. The next section presents common terms associated with mathematics performance of basic skills students.

Definitions

Adventure learning: An approach to instruction where teachers use online learning environments to engage students in solving authentic problems. Adventure-learning activities link curriculum-based educational activities in the classroom to researchers' experiences in the real world (Moss & Honkomp, 2011). Students work with other students, experts, teachers, and subject matter experts online to pose questions, analyze data, and take action to solve problems in their communities (Moss & Honkomp, 2011).

Basic skills mathematics population: General education students who score at the partially proficient level in mathematics as measured by the NJ ASK or LinkIt Benchmark Assessment (mathematics supervisor, personal communication, June 3, 2013). These students struggle to demonstrate mastery in computational, number sense, mathematical procedures, and problem-solving processes. Teachers provide targeted intervention strategies to improve performance of these students. Other terms used to identify this population are *struggling students*, *low-performing students*, *low-achieving students*, and *remedial students*.

Computation: Performing one-digit addition, subtraction, multiplication, and division basic fact problems. An aspect of computation is fluency, which is being able to solve simple calculations with speed and accuracy (Poncy et al., 2010). Computation is a fundamental skill in mastering higher level mathematics concepts (Geary, 2011).

Contextual teaching: A type of teaching where students engage in a learning activity that connects subject matter content to real-world situations (Cankoy, 2011).

Teachers use examples from everyday life that are familiar to students when teaching educational concepts (Cankoy, 2011).

Cooperative learning: Structured learning experiences where students work together to complete academic tasks. In cooperative learning tasks, each member has a role to fulfill, so the success of each member is dependent on the success of the group. The best type of tasks for cooperative learning are complex tasks that require multiple steps, multiple perspectives, and deep thinking to develop conceptual understanding (Mullins, Rummel, & Spada, 2011). In the mathematics classroom, students use group activities to verbalize their knowledge about mathematics by explaining and justifying their thinking about solutions to problems (Mullins et al., 2011).

Differentiated instruction: An approach to teaching where educators determine instructional strategies based on students' previous academic performance, learning style, and developmental level. Teachers use differentiated instruction to adapt content, process, product, or environment factors to accommodate ranges in readiness, learning styles, and interests of students (Tomlinson, 1999). Differentiated strategies include using multiple assessments that are tailored to different levels, providing options for student assignments that are tailored to student interest, and implementing pretest activities to allow students to opt out of lessons (Tomlinson, 1999).

Direct instruction: A type of teaching where the teacher uses explicit instruction to explain concepts, implements learning strategies to support the acquisition of information, and institutes guided practice to provide corrective feedback to address errors (Poncy et al., 2010).

Focus school: A school that is in need of improvement in areas such as graduation rates, achievement gaps, and performance of marginalized groups. A school becomes a focus school if the graduation rate is below 75%, the difference in performance between the highest performing group and the lowest two performing groups is higher than 42%, or the lowest two performing groups perform below the state average of 29% on the NJ ASK. Focus schools receive assistance from the state of New Jersey to design instruction to target individual student needs (NJDOE, 2013).

Intelligences: The eight abilities learners can employ when processing information, solving problems, and carrying out tasks. The eight intelligences are musical, visual, verbal, logical, kinesthetic, interpersonal, intrapersonal, and naturalist. Each person possesses a unique combination of the intelligences, which influences the learning process (Gardner, 2006).

LinkIt benchmark assessment: A formative test administered to students multiple times during the year to gauge students' understanding of the mathematics curriculum (LinkIt, 2012). The assessment allows teachers to use immediate results to identify learning issues and design intervention strategies to improve performance.

Math anxiety: The feeling of tension that negatively impacts learning while solving mathematics problems (Ayotola & Adedeji, 2009). Math anxiety can result from environmental, intellectual, or personality factors (Ayotola & Adedeji, 2009).

New Jersey Mathematics Assessment of Skills and Knowledge: A test administered to third – eighth grade students by the state to gauge the progress students are making toward mastering the knowledge and skills needed to pass the 11th grade test

required for graduation (NJDOE, 2012). The test assesses student ability in relationship to numeration, geometry, algebra, data and probability, and problem-solving. The test is aligned to state curriculum standards and provides meaningful information about student performance, which teachers use to create school improvement plans.

Number sense: “Non-verbal and implicit understanding of the absolute and relative magnitude of sets of numbers, objects, and symbols that represent numbers” (Geary et al., 2009, p. 266). Students apply a sense of numbers when they order numbers, measure distances, estimate reasonableness, and convert between different forms of numbers such as percent, fraction, and decimal representations. The National Council of Teachers of Mathematics (NCTM, 2000) incorporates multiple standards requiring students to use number sense to understand equivalence, reasoning about size, represent numbers on a number line, and convert numbers expressed in one unit to another unit.

Philosophical inquiry thinking: A student thinking process that involves constructing a deep understanding of mathematical processes, theories, and interconnected content through a process of questioning underlying assumptions in search for reasons (Knight & Collins, 2010). Philosophical inquiry thinking promotes deep learning because students use reasoning skills to inquire about natural wonderings of everyday life (Knight & Collins, 2010).

Problem-based learning: A student-centered approach to teaching where students are active learners who engage in solving real-life problems collaboratively. The goal of problem-based learning is to have students connect knowledge to real work in a way that

allows students to develop problem-solving, process, and collaboration skills (Bottge et al., 2010).

Problem-solving: A process that students use to solve simple and complex word problems. Effective problem solvers read the problem to gain an understanding of the context, information, and variables, devise a plan for solving the problem, implement the plan to obtain an answer, and look back to check for accuracy (Huang, Liu, & Chang, 2012). Students need to have knowledge about mathematical facts, symbols, algorithms, concepts, and rules to be able to devote attention to deeper thinking involved in problem-solving (Geary, 2011). Reading comprehension is another important prerequisite for effective problem-solving abilities (Kajamies et al., 2010).

Psychological factors: Community, family, peer, or social characteristics that influence learning. Self-esteem, confidence, anxiety, motivation, engagement, and self-efficacy are important psychological factors in mathematics achievement (Ayotola & Adedeji, 2009). These factors relate to fulfilling the universal psychological need for competence, autonomy, and relatedness (Ryan & Deci, 2000).

Remedial services: Intervention lessons designed to target learning issues and fill learning gaps so that students at risk of failure can reach the proficient level on standardized assessments. Remedial services are offered within the classroom environment, in a pullout atmosphere, or through after school programs.

Student-centered learning: An approach to instruction where students and teachers make decisions about content, activities, resources, and learning pace collaboratively. At the heart of student-centered learning is the idea that students should

construct knowledge by participating in active-learning experiences that allow students to develop their own solutions to open-ended problems by making real world connections (Poncy et al., 2010).

Student growth objectives: Academic goals that teachers create for groups of students (NJDOE, 2013b). The goals need to be specific, measureable, achievable, and ambitious (NJDOE, 2013b). Teachers need to use previous performance data to create student growth objectives that are aligned to the state curriculum (NJDOE, 2012).

Teacher accountability system: A New Jersey teacher evaluation system designed to comply with the TEACHNJ law passed in 2012 requiring all schools to establish a new system that uses multiple measures to evaluate performance of teachers (NJDOE, 2013a). ACHEVENJ is the name of the new teacher evaluation system in New Jersey. ACHIEVENJ mandates that districts use student growth percentiles that demonstrate student growth over time and state approved teacher observational instruments to determine effectiveness and tenure status of teachers (NJDOE, 2013a).

Working memory: “The complex cognitive system that is responsible for the storage and concurrent processing of information in the short term” (Witt, 2010, p. 948). Phonological loop, visuo-spatial sketchpad, episodic buffer, and central executive function are four components of working memory. The central executive function is responsible for storing relevant information, suppressing irrelevant information, and enabling the working memory to attend to multiple tasks (Witt, 2010). The phonological loop and the visuo-spatial sketchpad make up the central executive function. The phonological loop stores the sound of language, and the visuo-spatial sketchpad stores

visual and spatial information (Witt, 2010). The episodic buffer integrates the phonological, visual, and spatial information (Witt, 2010). Working memory is important in the development of reading, language, reasoning, problem-solving, and mathematical tasks such as computation (Geary, 2011).

Significance

The motivation to improve life is created from an established moral purpose (Fullan, 2001). Educators live out that desire by striving to make a difference in the lives of students (Fullan, 2001). Mathematics educators strive to improve the lives of students by seeking better methods to prepare students for the NJ ASK, develop students' conceptual understanding of mathematics, and promote a love for mathematics within the students. Sixth grade students in the state of New Jersey must acquire the grade-level appropriate computational, number sense, and problem-solving skills to demonstrate adequate progress toward mastering the knowledge and skills needed to meet the graduation requirement of passing the High School Proficiency Assessment (HSPA). Mathematics deficiencies on the NJ ASK and HSPA indicate that students do not possess the necessary skills for succeeding in college or the workforce, which means that educators need to transform mathematics instruction, especially for basic skills students. Teachers of sixth grade struggling mathematics students need to develop knowledge about how to improve students' working memory, computation, number sense, and problem-solving abilities. Teachers also need to learn about and implement instructional strategies to improve psychological factors such as self-efficacy of struggling mathematics students.

The purpose of the study was to understand teacher perceptions of mathematics instructional strategies for sixth grade basic skills students and to learn more about how computation, number sense, problem-solving, working memory, and self-efficacy impact mathematics learning of basic skills students. I examined teachers' perceptions to uncover what causes basic skills students to underachieve, which will allow teachers to develop stronger mathematical lessons. The results will help teachers understand effective intervention strategies to target deficiencies in number sense, computation, problem-solving, working memory, or self-efficacy. The results will add to the limited body of research on effective instructional strategies for general education students who struggle with mathematics. The study will be useful and relevant, as it will enable educators and students to grow in mathematical knowledge, which will evoke social change in mathematics achievement.

Research Questions

A wealth of research in the field of mathematics instruction focuses on understanding mathematics instruction in general and understanding how to design instruction to meet the needs of special education, ELL, low socioeconomic, and urban populations. The research databases examined contained very few studies designed to help mathematics educators understand instructional practices for struggling general education students. The limited research in the area of mathematics instruction for struggling learners from the past 5 years indicated that teachers tend to solely use traditional teacher-based teaching methods to teach mathematical concepts (McEwin & Greene, 2010; Pearce, Brunn, Skinner, & Lopez-Mohler, 2013; Sakshaug & Wohlhuter,

2010). Although teacher-based teaching has been successful for some students (Mullins, Rummel, & Spada, 2011), this approach to teaching does not attend to the varying learning styles of students fully (Kolb, 1984; McEwin & Greene, 2010), especially basic skills students who may need concrete learning experiences. Past researchers focused on examining how cooperative learning activities, in which students constructed mathematics knowledge through student-centered problem-solving tasks, impacted mathematics performance (Beecher & Sweeny, 2008; McEwin & Greene, 2010). Research results indicated that teachers need to use a variety of practices including lecture-based and student-centered learning to increase the likelihood that mathematics instruction meets the needs of each type of learner (Bottge & Grant et al., 2010; Leh & Jitendra, 2012). Past research also indicated that deficiencies in working memory caused struggling students to perform poorly in computational, number sense, and problem-solving tasks. Researchers also explored ways to reduce the cognitive load on the working memory to improve mathematics performance of struggling students.

Educators are charged with the task of ensuring that all students make adequate yearly progress toward student growth objectives. Currently, the basic skills mathematics population is underserved, as a high percentage of these students repeatedly score in the partially proficient category on the state assessment and fail to make progress toward student growth objective mandates. Aligning mathematics instruction to student psychological, social, emotional, and instructional needs might provide a vehicle for improving mathematics performance for remedial students and provide school systems with strategies to meet student growth objectives. In this case study, an investigation into

teacher perspectives on how to instruct struggling mathematics students was conducted using the following research questions:

1. What are sixth grade teachers' perceptions of the student self-efficacy factors that affect mathematics instruction for basic skills students?
2. What are sixth grade teachers' perceptions of the working memory of basic skills students?
3. What are sixth grade teachers' perceptions of problem-solving instruction for basic skills students?
4. What are sixth grade teachers' perceptions of computational instruction for basic skills students?
5. What are sixth grade teachers' perceptions of number sense instruction for basic skills students?
6. What are sixth grade teachers' perceptions of the challenges teachers face when providing instruction for basic skills students?

Review of the Literature

The review of current literature is focused on addressing the issue of underachievement in mathematics. Mathematics underachievement is a major problem in the United States that needs to be addressed by educators. First, mathematics knowledge is paramount to a country's success in a technologically advanced world (Ayotola & Adedeji, 2009). American students scored 35th out of the 40 highest achieving countries in the world on the 2009 Programme for International Student Assessment. The statistic remained relatively the same in 2012, 36th out of the top 40 countries, which points to the

need to improve student mathematics performance (Hammond, 2010). In response to concern over mathematics achievement gaps that exist for marginalized groups, the state legislature passed the TEACHNJ Act (NJDOE, 2013a), which requires schools to meet student growth objectives. Progress towards meeting student growth objectives will influence school and teacher evaluations under the new law. If schools fail to demonstrate adequate progress, schools risk the possibility that the state will impose sanctions, which include funding reductions and school takeovers. The federal government also provides Title 1 funding to help school organizations develop programs to improve mathematics performance. Title 1 funding supports the middle school basic skills program at the school under study; the district needs to demonstrate that the program is effective by raising test scores or risk losing Title 1 funding.

According to the New Jersey State Report Card, 12% of the total student population at the school under study scored below the proficient level on the 2012 NJ ASK (NJDOE, 2012). Currently, the mathematics program at the middle school in the study has addressed the concern about the progress of basic skills students by attempting to implement direct instruction, cooperative learning, hands-on activities, and differentiated instruction during regular classroom instruction in an effort to meet the varying needs of all students including basic skills students (mathematics teacher, personal communication, September 5, 2012). In addition, the school personnel provide remedial pullout services for basic skills students in an attempt to increase the performance of basic skills students. The district's philosophy for the basic skills program is to provide the students with instruction that will target mathematic

deficiencies and accommodate individual learning styles so that basic skills students will reach the proficient level on the NJ ASK at the end of the year (mathematics supervisor, personal communication, October 10, 2012). The basic skills population is transient as the goal is to fill learning gaps so that students will not need interventions the following year. In spite of these efforts, a portion of the basic skills population still struggles to learn the necessary content to perform at the proficient level on the state assessment.

Results from the 2009 Randomly Selected and Highly Successful Middle School Survey (McEwin & Greene, 2010) revealed that 93% of the 101 highly effective middle schools were successful in that more than half of the student population in the schools scored above the proficient level on standardized mathematics tests. During the years from 2008-2012, only 30-40% of the total student population at the school under study scored above the proficient level. Different states used different mathematics assessments during the time period studied, which may have affected the level of rigor, but the fact that the state deemed the middle school of study a focus school demonstrated that the middle school failed to achieve a highly effective level. The highly successful schools performed 11 points higher than schools in the random control group on standardized mathematics assessments (McEwin & Greene, 2010). Teachers need to understand the reasons for the discrepancy between the varying levels of success of the middle school under study and highly successful middle schools so that teachers can evoke positive change in mathematic achievement of basic skills students; therefore, the literature review is focused on studies that identify best instructional practices for struggling mathematics students.

The review of current literature associated with the instruction and performance of remedial mathematics students included over 100 peer-reviewed articles. I examined multiple databases using search terms related to *problem-solving*, *computation*, *number sense*, *working memory*, and *self-efficacy*, which teachers identified as problematic mathematical areas for struggling students. Adding the search terms *remedial*, *struggling students*, *elementary*, and *middle school* narrowed the topic. Evaluating the usefulness of each article based on a set of criteria related to the problem narrowed the search further.

Studies included in the literature review related to suburban settings and included studies focused on White students because White and suburban characteristics described the middle school under study. Studies included in the literature review also discussed implications for struggling mathematics students and included participants from kindergarten through middle school. I used studies focused on students under fourth grade only if the study included an analysis about implications for middle school students in the discussion section of the article. The search included the K-eighth age range based on the theory that struggling students display a history of failure dating back to primary grades (Geary, Hoard, Nugent, & Bailey, 2011). In the literature review, I analyzed peer-reviewed articles that met the criteria to illuminate underlying issues for struggling mathematics students. The review of literature included findings related to three areas: mathematical skills, cognitive processes, and psychological factors. I reached saturation of the literature by conducting searches in multiple databases. I used Education from Sage, Education Research Complete, Eric, and psycINFO to ensure that the literature review presented the most current research in mathematics education and a diversified

perspective on best mathematical practices. I also used the reference lists of the studies summarized in the literature review to identify further related studies. Finally, I felt confident in reaching saturation when searches yielded no new authors or studies.

Conceptual Framework

The primary conceptual framework that informed this study was David Kolb's (1984) experiential learning theory. Kolb supposed that experience influences student learning and creates knowledge (Kolb, 1984; Kolb, Boyatzis, & Mainemelis, 1999). As a student experiences a learning situation, the student uses mental capacities to grasp and transform knowledge (Kolb, 1984; Kolb et al., 1999). In this process, the learner must choose how to grasp and transform the knowledge by employing concrete, symbolic representation, reflective observation, or active experience (Kolb, 1984; Kolb et al., 1999). Learners will use the mental capacity processes in a patterned way based on hereditary factors, past experiences, and situational demands (Kolb, 1984; Kolb et al., 1999). The learners display the mental capacities through four distinct learning styles.

Diverging learners rely on mental capacities related to concrete reflective activities, which incorporate cooperative learning as a means to gather information and generate ideas (Kolb, 1984; Kolb et al., 1999). The second learner, the assimilating learner, prefers to use abstract and reflective observational abilities, listen to lectures, and read to gather information and form logical explanations (Kolb, 1984; Kolb et al., 1999). Accommodating learners rely on concrete and active experiences that incorporate hands-on, collaborative opportunities and allow students to test approaches (Kolb, 1984; Kolb et al., 1999). The last learner, the converging learner, uses abstract concepts and active

experiences to process information and prefers technical tasks and experiments (Kolb, 1984; Kolb et al., 1999).

The converging learning theory is a significant factor in mathematics learning as traditional math lessons focus on teaching to the abstract learner through direct, lecture-based instruction (mathematics teacher, personal communication, April 16, 2013); this type of learning will meet the learning needs of the converging learner only. Kolb's (1984) theory suggested that teachers should also meet the needs of diverging, accommodating, and assimilating learners by implementing lessons that incorporate differentiated activities. Educators should consider Kolb's suggestions when considering the factors that affect problem-solving, computational, number sense, working memory, and self-efficacy abilities of struggling mathematics students. Vygotsky's (1978) social development theory and Maslow's (1943) motivation learning theory also informed aspects of the study. The literature review includes an analysis of the learning theories later as they relate to current literature.

Mathematical Skills

Problem-solving. An analysis of current literature revealed several reasons for poor achievement in the area of problem-solving. Researchers found that students perform low on problem-solving questions because students struggle with reading comprehension issues (Coddling, Archer, & Connell, 2010; Kajamies et al., 2010; Mate, 2012; Pearce, Brunn, Skinner, & Lopez-Mohler, 2013). Coddling et al. (2010) conducted an experiment to test the effects of incremental rehearsal drill on problem-solving performance of seventh grade students and discovered that low performance related to the

embedded nature of number facts. Students struggled to locate needed mathematical information within the context of language (Coddling et al., 2010). A quantitative study conducted to determine how sixth grade Romanian students understand text revealed that 67% of the students could not answer word problems that contained useless information (Mate, 2012). The posttest results indicated that students lacked the ability to comprehend what information to attend to and what to ignore (Mate, 2012).

Researchers conducted a 3-year longitudinal study and analyzed the results of third grade students' performance on computational, problem-solving, and cognition tests to determine whether computational deficits cause problem-solving issues for struggling mathematics students (Fuchs, Fuchs, Stuebing, & Fletcher, 2008). Fuchs et al. (2008) discovered that difficulty in computation did not necessarily translate to difficulty in problem-solving abilities. Instead, the test results signaled that language deficits related more strongly to the problem-solving issues while inattentive behavior and poor processing speeds affected progress with computational performance (Fuchs et al., 2008).

A qualitative study conducted to elicit fourth and fifth grade teacher ideas about why students struggle with word problems revealed that 24% of teachers felt that students experienced text difficulties partly due to changes in complexity of word problems by state assessment creators (Pearce, Bruun, Skinner, & Lopez-Mohler, 2013). Twenty-nine percent of the teachers believed that these changes in complexity also increased the need to find multiple solutions to word problems (Pearce et al., 2013). Duan, Depaepe, and Verschaffel (2011) conducted a mixed methods study to understand Chinese teachers' understanding of problem-solving instruction. The researchers provided teachers with

training in solving complex word problems and found that both teachers and students scored lower on problems with complex situations that require multiple solutions (Duan et al., 2011). According to the findings of the researchers, high complexity level may partially explain poor performance in problem-solving.

Research also indicated that remedial students struggle to apply mathematical processes when solving word problems (Berends & van Lieshout, 2009; Cankoy, 2011; Edens & Potter, 2008; Huang et al., 2012; Jacobse & Harskamp, 2012; Kim & Noh, 2010; Lin & Cho, 2011; Mate, 2012; Tolar et al., 2012; Voskoglou, 2011). Mathematical communications, reasoning, and modeling represent three significant mathematical processes described in the newly adopted CCSS (Common Core State Standard Initiative, 2012b). The mathematical communication standard states that students need to construct arguments and defend math reasoning used to solve problems (State Standard Initiative, 2012b). Kim and Noh (2010) conducted a case study to determine how descriptive problems and rubrics helped teachers improve learning of third through sixth grade Korean students. Kim and Noh discovered that students scored the lowest on communication ability on the descriptive assessment. The students appeared to lack the ability to explain the thinking used to solve problems in the study (Kim & Noh, 2010). The process of metacognition involves understanding one's own thinking, so a weakness in metacognition could cause poor communication skills (Kim & Noh, 2010). Jacobse and Harskamp (2012) conducted a quantitative study to investigate what strategies best measure student metacognition ability. The think aloud, self-reported, and combination measure results indicated that the majority of fifth grade students scored low in

metacognitive ability, and the researchers concluded that students do not reach maturity in the ability to use metacognition until after middle school (Jacobse & Harskamp, 2012). Current research findings provided evidence for a link between poor verbal and written communication skills and poor problem-solving skills.

Students use mathematical reasoning by making sense of quantities and thinking abstractly (State Standard Initiative, 2012b). The CCSS states that students need to use abstract thinking to understand mathematical relationships by engaging in creative, critical, convergent, and divergent thinking. The quantitative study conducted to determine the relationship between divergent thinking, convergent thinking, motivation, and knowledge with fifth and sixth grade Taiwanese students indicated that the lowest performing students displayed less creative thinking than the highest performing students (Lin & Cho, 2011). Lin and Cho (2011) found that divergent thinking and convergent thinking correlated with creative thinking. A longitudinal study designed to understand the relationship between complex word problems, academic skills, and cognition using third through fifth grade students identified nonverbal reasoning as the strongest predictor for success on complex problems (Tolar et al., 2012). Voskoglou (2011) conducted a meta-analysis study to determine the role of the math problem in learning and found a weakness in students' analogical reasoning ability. The students struggled to make mathematical comparisons to answer analogical word problems. Students who displayed a weakness in nonverbal reasoning skills such as analogical, creative, divergent, and convergent thinking struggled with problem-solving tasks.

Students use mathematical modeling to identify the relationship between important quantities and represent them visually (Common Core State Standard Initiative, 2012b). Edens and Potter (2008) conducted a qualitative study to describe the ways upper elementary school students spontaneously represent mathematical information graphically. The researchers found a significant correlation between problem-solving, spatial ability, and drawing skills (Edens & Potter, 2008). Students who drew schematic pictures with details demonstrating the relationship between the numbers scored higher on the problem-solving project (Edens & Potter, 2008).

The children's literature study conducted by Cankoy (2011) confirmed the results that schematic drawings improved students' problem-solving abilities. The students in the treatment group benefitted from the contextual instructional strategy of embedding word problems in familiar literature. The students in the treatment group made more schematic representations than students in the control group, which led to higher problem-solving performance (Cankoy, 2011). The use of schematic visuals appeared to improve problem-solving performance; however, the use of illustrations that accompany word problems also caused issues for students with poor computational skills. Berends and van Lieshout (2009) conducted a 2 x 4 mixed design study to examine the effect of combined textual and visual information on word problem performance. The fifth grade students with poor computational skills experienced a drop in accuracy and speed in solving word problems when the students had to reference illustrations for essential information (Berends & van Lieshout, 2009). In the case with essential information, the

use of illustrations affected performance negatively. The inability to understand visual representations of mathematical concepts can impact problem-solving performance.

Research also found that teacher preparedness related to poor performance in problem-solving (Marchis, 2011; Pearce et al., 2013; Sakshaug & Wohlhuter, 2010;). Sakshaug and Wohlhuter's (2010) action research study designed to provide teachers with problem-solving experiences as a learning tool to improve instruction found that 39% of the teachers in the study experienced discomfort with the concepts, reasoning, and communication involved in solving complex word problems. These teachers tended to be directive when teaching problem-solving skills by providing students with the important information and strategies instead of allowing students to construct the process for themselves (Sakshaug & Wohlhuter, 2010).

Marchis (2011) used a qualitative design to understand how teachers guided students in problem-solving. The results revealed issues with the strategies teachers incorporate during problem-solving instruction. Teachers focused more time on reading the text, writing down key points, and rewording questions but approximately two thirds of the teachers failed to incorporate opportunities essential for students to find multiple strategies and explain solutions (Marchis, 2011). Pearce et al. (2013) also conducted a study to understand teacher' perceptions about problem-solving issues and found that only 21% of the teachers used cooperative learning and only 19% used manipulative-based instruction, two research-based strategies. Pearce et al. also determined that teachers failed to teach the problem-solving strategies presented in the curriculum for

fourth and fifth grades fully, which prevented students from developing the background necessary to solve diverse problems.

Current research findings from multiple studies confirmed the theory that language, nonverbal reasoning, spatial, and teacher preparedness deficits predict poor problem-solving performance for struggling students. Many teachers lacked the abstract understanding of mathematical concepts and instructional background required to incorporate strategies to accommodate diverse learning styles. Struggling students lacked the communication, spatial skills, and reasoning skills needed to employ concrete, representative, reflective, and active mental capacities. Teacher and student deficits contributed to an imbalance in development and usage of the mental capacities needed to grasp mathematical concepts described by Kolb (1984). Based on the conflicting findings regarding the use of visual representations, researchers should conduct more research to clarify how teachers should use visual representations during mathematics instruction.

Based on the current findings related to what causes poor problem-solving performance, the study was designed to gain an understanding of teacher's perceptions about reading comprehension and ability to solve complex word problems and communicate mathematical thinking of basic skills students. The study was designed to determine if the teachers at the middle school under study agree with the research about the causes of poor problem-solving performance or if the teachers identify other others of concern in problem-solving ability of basic skills mathematics students. The researchers also identified teacher preparedness as an issue; therefore, the study investigated

teachers' perceptions about whether the teachers feel equipped with the knowledge and resources to improve the problem-solving skills of basic skills students. The literature review included a limited amount of research about the effectiveness of mathematics textbooks in containing best teaching practices, but the studies did not focus on the textbooks' effectiveness to teach problem-solving skills; therefore, the study investigated teacher perceptions about the quality of the textbook problem-solving lessons.

Teaching approaches. Current researchers investigated the issue of traditional instruction and found implications in line with Kolb's (1984) converging learning theory. Several studies tested the effects of computer software programs and found that computer programs improved problem-solving performance (Bottge, Grant, et al., 2010; Huang et al., 2012; Leh & Jitendra, 2012; Powell & Fuchs, 2012; Schoppek & Tulis, 2010). Bottge and Grant et al. (2010) conducted a randomized comparison pretest posttest study to determine the effects of Enhanced Anchored Instruction on middle school student learning. The researcher compared three groups: explicit instruction group, embedded instruction group, and regular class instruction group. The embedded instruction group received the treatment of computer software to enhance instruction. The embedded instruction group displayed higher problem-solving performance than the other two groups, especially for struggling students (Bottge, Grant, et al., 2010). Bottge and Grant et al. credited the improved performance to the multimedia and hands-on aspects of the embedded instruction. Teachers and students agreed that computerized programs offered strong instructional options through the use of feedback and motivation to improve problem-solving performance.

Leh and Jitendra (2012) conducted a survey of third grade students and teachers to determine the effectiveness of computer-mediated instruction versus teacher-mediated instruction. The teacher survey results indicated that teachers believed in the effectiveness of both instructional strategies in enhancing problem-solving abilities and the state and maintenance test results validated the effectiveness (Leh & Jitendra, 2012). Teachers stated that engagement and feedback opportunities provided through both activities and individualized instructional time provided through the computerized program accounted for growth in problem-solving performance (Leh & Jitendra, 2012). The second and third grade low-achieving Taiwanese students from a mixed methods study confirmed the effectiveness of computer software and stated that the computer-based program used in the study increased student knowledge of problem-solving steps and improved their performance (Huang et al., 2012).

The results of a pilot study conducted by Khan Academy provided information to validate the success rate of improving student test performance by combining explicit instruction with computerized software. Khan (2011) developed mathematics software tutorials for students to use to understand mathematics concepts. Khan gathered research data from a pilot study conducted by two fifth and two seventh grade classes in California. The teachers in the pilot study created a flipped classroom technique where students watched explicit instruction videos on mathematics concepts at home and used instructional time to provide guided and independent practice on mathematical problems. The results of the pilot study revealed that the flipped classroom approach enabled the high functioning school district to improve student performance at the proficient level on

the California standardized math exam from 91% to 96% in one year (Izumi, Fathers, & Clemens, 2013). The results also revealed that the low-achieving mathematics students improved the most. The percentage of students performing in the lowest performance levels dropped from 29% to 12% as a result of the flipped classroom technique (Kahn Academy, 2013). Khan (2011) attributed the success of the program to the individualized lessons provided by self-paced tutorials, individualized instruction provided by the teacher, consistent practicing of problems, and constant corrective feedback given to students in class.

Other research results in computer software verified the effectiveness of individualized instruction with low-achieving students. Several of the computer programmers designed software to individualize student instruction based on baseline data obtained from the preassessment given when first using the computer programs (Powell & Fuchs, 2012; Schoppek & Tulis, 2010). An experiment conducted by Powell and Fuchs (2012) with first grade at-risk students revealed that the *Galaxy Math* tutor program improved word-problem performance as a result of the individualized practice the program offered. Schoppek and Tulis (2010) credited growth in problem-solving performance of third grade German students to the hierarchy of skills design in the *Merlin's Math Mill* computer program used in the study. The computer software programs set problem levels based on student progress, which allowed students of all levels to experience success.

Other research studies on computer software indicated mixed results. Researchers revealed that students with limited background knowledge performed better in explicit

instruction situation than computer software (Bottge & Grant et al., 2010). Combining computer instruction with other instructional approaches might provide an alternative option. Schoppek and Tulis suggested that incorporating *Merlin's Math Mill* with other problem-solving instructional strategies would enhance the benefits of the program while Powell and Fuchs believed that computer software should include aspects of explicit instruction to ensure success. Researchers also revealed that the use of the *Go Solve Word Problems* computer software resulted in a slight advantage in retention levels for struggling students, while the *Solving Math Word Problems* teacher instruction resulted in higher transfer levels on the standardized test (Leh & Jitendra, 2012). Combining computer software programs with explicit instruction might improve the quality of instruction of struggling students.

Two researchers studies validated the effectiveness of explicit teacher instruction. Piper, Marchand-Martella, and Martella (2010) conducted an action research study to determine the effectiveness of explicit double dosing instruction on problem-solving performance of seventh grade struggling students. The term *double dosing* refers to providing a certain amount of additional teacher instruction on top of the 5 days of regular instruction per week. The intervention and control group both received explicit instruction, but the intervention group also received 25 minutes of additional instruction once a week. The researcher used two types of assessments, instructional quizzes and a post assessment, to measure effectiveness of explicit double dosing instruction. The post assessment contained a section in which students used calculators and a section in which students did not use calculators to solve mathematical problems. The performance of at-

risk students increased an average of 52% on non-calculator, 46% on calculator, and 73% on quiz questions (Piper et al., 2010). The significant increase in performance indicated that explicit double-dosing instruction benefitted struggling mathematics students. A program evaluation was conducted to study the extent to which three popular second and fourth grade textbook series incorporated to effective principles of instruction and found an overall weakness in the three textbook series (Doabler, Fien, Nelson-Walker, & Baker, 2012). The results of the evaluation revealed that only 30% of the lessons in the textbooks contained elements of explicit instruction (Doabler et al., 2012). The textbook series creators failed to provide teachers with quality instructional lesson plans. Doabler et al. (2012) recommended that teachers enhance instruction to improve the quality of explicit instruction, student-teacher interactions, feedback, and student practice.

Researchers found evidence of the effectiveness for both computerized and teacher-mediated instruction, which validated Kolb's (1984) converging learning theory. Teachers who use explicit mediated instruction accommodate logical and abstract learners by presenting material in a systematic way, and the use of computer software helped the teacher meet the needs of active and concrete learners by incorporating visual representations and interactive problems. Each classroom contained a blend of Kolb's learning styles; therefore, educators will need to incorporate explicit, computerized, and other approaches to meet the needs of students. The complex results indicated the need for teachers to understand the four learning styles, determine each student's personal learning styles, and know how to design lessons to foster the problem-solving skills of

each learner. Educators should conduct more research on computerized and teacher mediated strategies to provide a clear picture of effective problem-solving instruction.

Teachers at the middle school under study spend a majority of regular classroom instructional time using explicit instruction. Based on the positive results of explicit instruction found in the research review, the study was designed to help me understand how teachers implement explicit instruction. Specifically, I investigated how much time teachers engage students in practicing problems and how often teachers provide students with feedback. I also focused on understanding teachers' perceptions about the usage of computerized software to enhance problem-solving instruction. The review of current research did not yield studies related to teachers' perceptions about preparedness in using computer software; therefore, I focused on understanding what challenges teachers face in implementing computer software.

Instructional strategies. Researchers have revealed effective pedagogical approaches to teaching mathematics. Slavin et al.'s (2009) meta-analysis on effective mathematics characteristics of instruction found that teachers' use of instructional strategies impacted student learning significantly; therefore, teachers need to respond by developing a repertoire of teaching strategies that will meet students' needs and encourage participation, engagement, and desire. Researchers, furthermore, supported the concept of differentiated instruction. Beecher and Sweeny's (2008) document and testing analysis study results indicated that students who learn by participating in differentiated activities developed positive attitudes, increased engagement, and improved achievement in all subject areas. Beecher and Sweeny described differentiated

instruction as designing instructional activities that take into account students' individual interests, learning styles, strengths, and needs. In fact, differentiated programs resulted in a narrowed achievement gap between socioeconomic levels and ethnic groups (Beecher & Sweeny, 2008). Kajamies et al.'s (2010) pre- post-test experiment to determine if low achievers benefit from scaffolding, cognition, and metacognitive activities embedded in the differentiated computer programs found that remedial mathematics student' performance improved and students maintained performance over time.

Other researchers discussed the importance of teacher knowledge in improving student mathematic performance (DiTeodoro, Donders, & Kemp-Davidson, Robertson, Schuyler, 2011; Duan, Depaepe, & Verschaffel, 2011; White, 2009). White (2009) conducted an experiment to determine if the *Count On Program* improved mathematics learning. The experimental group of teachers received training in a 10-week intervention program. Results of the posttest found that professional development in *Count On* improved place value, computational, and problem-solving student performance (White, 2009). The program led to improvements because teachers received appropriate resources to improve mathematical knowledge and instructional strategies, and worked collaboratively to plan and reflect (White, 2009). An action research study conducted to help the researcher determine if teacher training in mathematics questioning would increase the use of good questioning by students and teachers indicated that training increased teacher use of deeper questioning from 25% to 69% (DiTeodoro et al., 2011). Teachers explained that the awareness the training provided improved the quality of teacher questioning abilities (DiTeodoro et al., 2011).

Another effective pedagogy approach for teaching problem-solving illuminated in current research related to effective questioning. Researchers found that student performance improved as the result of higher-level questioning activities (DiTeodoro et al., 2011; Huang et al., 2012; Kapur, 2011; Sakshaug & Wohlhuter, 2010). In the mixed method study designed by Huang et al. (2012), the second and third grade students indicated that guided questions embedded in the computer-based intervention helped to identify the main ideas from the word problem. Kapur's (2011) quasi-experiment to test how productive failure affected the learning of seventh grade students from Singapore discovered that the "what if" scenario strategy group developed more flexibility and adaptation skills when solving word problems and outperformed the "lecture" group. The research indicated that higher-level questioning improved problem-solving performance.

Researchers found that students benefitted from understanding the different types of word problems and steps needed to reach a solution for a word problem (Csíkos, Sztányi, & Keleman, 2012; Huang et al., 2012; Mate, 2012; Voyer, 2011). Csíkos et al. (2012) designed a pre- and post-test experiment to determine if using real-life problems would increase third grade Hungarian student usage of drawings when solving word problems. The intervention made the students aware of modeling and visual word problems, which increased student performance more from the pretest to the posttest as compared to the control group (Csíkos et al., 2012). Voyer (2011) conducted a mixed method experiment to determine if different types of word problems related to student performance. The results revealed that students performed better when word problems

contained themed information that explained the real-life context of the problem (Voyer, 2011). Students with poor problem-solving skills struggled to ignore the situational information problems that contained non-essential information.

Researchers also suggested that teachers should instruct students to use problem-solving steps to improve performance. The students in Huang et al.'s (2012) experiment designed to test the effectiveness of computer software claimed that the embedded double-check step helped students to evaluate solutions and consider alternate strategies, which improved performance. Mate's (2012) experiment results on student's understanding of text indicated that students with a history of poor problem-solving ability performed better when presented with a plan to follow because plans helped organize information and reduce the need to remember information.

Researchers found that effective instructional strategies in mathematics learning engaged students in real-life learning activities. Bottge and Rueda et al. (2010) conducted a study to determine if direct instruction or problem-based learning made a difference in mathematics performance for middle school students. Pretest- and post-test experimental data revealed that embedding computational skills into problem-solving activities increased student performance more than direct instruction. The students who participated in real-life learning embedded in problem-based learning tasks used inquiry-type thinking to analyze the problem and propose solutions. Philosophical inquiry thinking involves constructing a deep understanding of mathematical processes, theories, and interconnected content through a process of questioning underlying assumptions in search for reasons (Knight & Collins, 2010). Students inquire about mathematics

concepts such as understanding the reasons for counting and how numbers relate to the world (Knight & Collins, 2010). Knight and Collins (2010) argued that students who use philosophical inquiry learning develop a deep understanding in all subject areas including mathematics because students used reasoning skills to inquire about the natural wonderings of everyday life. Cankoy (2011) used a two-way repeated measures experiment to determine how using children's literature would affect problem understanding for third grade students from Lefkosa. Cankoy believed that the contextual attributes of literature used in the study gave meaning and familiarity to problem-solving situations, which helped students of all levels improve problem-solving performance. Students who use problem-based learning that involves philosophical thinking and familiar contexts see value in mathematics learning.

Researchers also revealed that collaborative approaches used to teach problem-solving skills resulted in positive gains for struggling students. Kajamies et al. (2010) studied the effects of scaffolding on problem-solving performance and discovered that 10-year old low-performing Finnish students benefitted from the combination of individualized computer instruction and teacher coaching experiences provided as interventions. The preservice teachers from the Sakshaug and Wohlhuter (2010) study noted that cooperative learning experiences benefitted both teachers and students especially when stronger students peer tutored lower achieving mathematics students. Tzuriel and Shamir (2010) further confirmed the link between peer tutoring and improved problem-solving performance for struggling students. The treatment by training 2 x 2 quantitative design investigated the affects of tutoring programs on mathematics

performance. The researchers selected third grade students to serve as tutors for kindergarten students randomly. The sample consisted of 78 tutor-tutee dyads. The researchers randomly assigned each dyad to either the experiment or control group. The experiment tutors received training in the *Peer Mediation with Young Children* program while the tutors in the control group received a generic substitute program. The posttest results revealed an increase in problem-solving performance for both the third grade tutors and the kindergarten tutees. Tutees in the experimental group had twice the increase of the amount learned when compared to the tutees in the control group on the problem-solving assessment.

Researchers agreed that improvements in quality of instruction resulted in improved problem-solving skills for struggling students. Teachers who differentiate instruction supported Kolb's (1984) converging learning theory as teachers designed knowledge and acquisition activities based on student learning styles. The teachers who asked deep questions tapped into the converging learners need to experiment, and teachers who implemented problem-solving steps fostered diverging learners need for reflection and assimilating learners' preference for logical approaches. The process of peer tutoring stimulated diverging learners interest in cooperative learning, and teachers who use real-life learning nurtured the diverging, accommodating, and converging learners' desire for active learning.

Based on the positive results of differentiated instruction, real-life learning, and questioning strategies in improving problem-solving performance for struggling students, I investigated teachers' perceptions of using differentiated instruction and metacognitive

thinking with basic skills students. I focused the study on determining whether teachers incorporate the best practices into the problem-solving instruction for basic skills students and what challenges teachers face with differentiated instruction and questioning strategies. I also investigated teacher use of problem-solving steps to determine if the teachers at the middle school under study present a consistent plan for the problem-solving process. The current review of literature did not yield studies about teacher preparedness to implement real-life learning; therefore, I investigated teachers' perceptions about the textbook quality in presenting real-life connections and teacher understanding of real-life learning. Researchers also presented limited research connecting mathematics performance to problem-based learning; therefore, I focused on understanding teachers' perceptions about the effectiveness of problem-based learning in improving mathematics performance of basic skills students.

Computation. A review of the literature indicated the root causes of computational issues for struggling middle school students. The issues related to deficiencies in fluency and conceptual understanding of mathematical processes. Fluency is defined as the rate of speed and accuracy in recalling basic mathematical facts. The learning theorist Lev Vygotsky (1978) developed a theory about social development that informs the computational aspects of the study. Vygotsky believed that external factors influence learning, and that society develops its own potential for learning. Social interaction is an important factor in learning according to the social development theory, and Vygotsky believed that students develop through a combination of social interactions and independent activities. Vygotsky defined the social aspect of the theory as the

process by which a “more knowledgeable person” assists the student in the learning process through coaching interactions. Vygotsky’s “more knowledgeable person” can consist of teachers, coaches, peers, or computers. Vygotsky explained that child development and learning rate relate to each other in a way that development always lags behind learning to create a zone of proximal development. The actual developmental level identifies what students master and perform independently, whereas the zone of proximal development reveals a child’s potential with assistance. Vygotsky believed that the best instruction occurs in the zone of proximal development because educators can use the peer-coaching process to scaffold instruction to help students to internalize new learning at a differentiated pace. Vygotsky’s stressed the importance of using scaffolding, peer tutoring, discourse, and reciprocity during instruction. The social development theory relates to the concepts of computational skills, number sense, and working memory because students vary in the ability to recall mathematical procedures and need differentiated instruction.

Hecht and Vagi (2010) conducted a longitudinal study to compare the performance of fourth and fifth grade typical and struggling students on fraction problems. The majority of the mathematics standards assessed computational abilities through fractional concepts at the middle school level (Common Core State Standards Initiative, 2012a). In Hecht and Vagi’s study, students took a series of intelligence and mathematical skills tests, and the results indicated that arithmetic fluency predicted growth in fraction computational performance ($R^2 = .46$). Arithmetic fluency, however, did not fully explain the differences between typical and struggling student performance

(Hecht & Vagi, 2010). The researchers found that working memory ($R^2 = .49$), attentive behavior ($R^2 = .52$), and picture computation abilities ($R^2 = .52$) where students used pictures to add rational numbers also predicted performance in computation (Hecht & Vagi, 2010). Based on the results of this study, typical and struggling students experienced the same issues with fraction computation, but struggling students struggled more as demonstrated by Cohen's d effect sizes (fourth grade $d = 1.39$ and fifth grade $d = 1.39$).

A mixed methods study was conducted to determine if strategy choice affected computational performance of sixth grade students from the Netherlands. Researchers revealed that lower achieving students used mental math more often than written strategies and made more errors than typical-functioning children (Hickendorff, van Putten, & Verhelst, 2010). Hickendorff et al. (2010) found that requiring students to demonstrate work through written strategies improved performance. Mullins et al. (2011) conducted a study to determine the effect of procedural versus conceptual activities on mathematics computational performance of eighth grade students. Mullins et al. determined that students relied on rote memorization of rules and trial and error methods for solving computational problems, which limited the development of a conceptual understanding and affected mathematical performance. The results of research studies indicated that causes of poor computational skills related to varying student abilities in fluency and conceptual understanding in mathematics.

Based on the findings related to the causes of poor computational performance, I focused on eliciting teacher perceptions about causes of poor computation of basic skills

students to see if teachers agree that fluency, carelessness, and rote memorization negatively affect the basic skills students' computational performance. I also provided teachers with the opportunity to identify other problematic areas in computational performance.

Instructional approaches. Researchers revealed several instructional approaches to teaching computational skills. Researchers identified computer software approaches as beneficial in helping struggling students get individualized fluency practice. Bottge and Rueda et al.'s (2010) randomized comparison study results indicated that students who practice fluency embedded in computer software performed higher on computational assessments as a result of the practical practice time. Another experiment conducted to examine the effects of a computerized-based mathematics fluency intervention for at-risk third and fourth grade students resulted in large increases in computational performance for students (Burns, Kanive, & De Grande, 2012). The percentages of at-risk students scoring above the 25th percentile on assessment data rose from 30.6% to 42.8% for third graders and 29.1% to 42.5% for fourth graders from the pretest to posttest measures (Burns et al., 2012). Burns et al. (2012) credited the improvement to the increase in practice targeting unknown facts.

Researchers identified *Merlin's Math Mill*, *Math Facts*, and *Math Facts in a Flash* as specific math programs that improved computational performance. Schoppek and Tulis (2010) conducted an experiment to determine if independent practice using *Merlin's Math Mill* would improve mathematics performance for third grade German students. Many of the students in the study experienced low achievement on

mathematics assessments prior to the study. Results signaled that small amounts of individualized practice with the program enabled all students to improve computational skills (Schoppek & Tulis, 2010). The experiment designed to test effects of the *Math Flash* computerized tutor program also indicated that struggling third grade students improved fact retrieval as a result of the computerized experience (Powell, Fuchs, Fuchs, Cirino, & Fletcher, 2009). Powell et al. (2009) believed that feedback provided by the computer accounted for the difference in performance.

The study conducted by Stickney, Sharp, and Kenyon (2012) using data from *Math Facts in a Flash* and the STAR mathematics test indicated key computational issues that struggling students experience. The low-achieving second and third grade students mastered fewer facts, needed more time, made more attempts, and made less progress while completing tasks in the study (Stickney et al., 2009). In spite of the computational issues, findings also indicated that the *Math Facts in a Flash* program helped low-achieving students make progress in fluency of addition and subtraction facts and reach similar levels of success as typically achieving students once students mastered fluency of basic facts (Stickney et al., 2009). The research indicated that providing individualized computerized practice can help struggling students build fluency skills and improve mathematics performance by giving students the extra time needed to learn basic facts.

Researchers also found viable evidence for the importance of building procedural and conceptual knowledge to improve computational performance. Alon (2012) developed a case study to determine if a referent-based approach would impact

computation of fractions. The sixth grade students in the treatment group demonstrated stronger fraction performance growth from the pretest to posttest than the control group (Alon, 2012). The definition approach helped students develop a stronger understanding of the part-whole relationships of fractions. Poncy et al. (2010) conducted an alternating experiment with two treatment groups and one control group to determine if a behaviorist or constructivist approach to teaching had a greater impact on student mathematics performance. The results indicated that 95% of the second grade students using the behaviorist approach of applying cover, copy, and compare demonstrated growth while only two of the constructivist students using the *Facts that Last* exploration of fact families program improved in fluency (Poncy et al., 2010). The behavioral approach proved more beneficial in developing computational skills than the constructivist approach.

Researchers designed an experiment to compare the effect of the *Knowing Math* conceptual instruction and the *Extended Core* explicit instruction format on computational achievement (Ketterlin, Gellar, Chard, & Fien, 2008). *Knowing Math* interventions related to re-teaching mathematics skills through think-aloud dialogue to build understanding about reasons behind the mathematics procedures whereas *Extended Core* explicit instruction focused on providing extra time to learn concepts (Ketterlin et al., 2008). The results revealed that both programs had a strong effect size, but explicit instruction program impacted student growth on the state test more likely because *Extended Core* aligned to grade-level standards (Ketterlin et al., 2008). The conceptual instruction program incorporated on grade-level prerequisite skills, so benefits of the

program may not appear until later grades (Ketterlin et al., 2008). Results indicated that both extra time and think aloud dialogue enhanced student computational performance.

Mullins et al. (2011) discovered that the computational goals of instruction affect types of instruction. In an experiment with eighth grade students using conceptual and procedural instruction with and without collaborative activities, the use of collaborative activities improved accuracy for the conceptual group more than the procedural group. The researchers concluded that when developing conceptual knowledge, teachers should use collaborative learning activities to help students to discover concepts and when developing procedural knowledge teachers should implement explicit instruction with independent practice (Mullins et al., 2011). Researchers found that explicit computational approaches that offer referent-based instruction and individualized practice provide the most promise for immediate gains in computational performance. Findings related to Vygotsky's (1978) theory of the zone of proximal development in that explicit teaching or computer software provided individualized instruction to target a child's individualized computational needs.

Based on the positive results of computer software, I investigated teachers' perceptions about using computer software to enhance computational instruction. I focused on understanding teachers' decision-making process in determining when to use computer software, explicit instruction, and cooperative learning while teaching computational concepts. I uncovered teachers' perceptions about the effectiveness of computerized, explicit, and cooperative learning instruction in improving computational performance of basic skills students.

Instructional strategies. Researchers conducted studies to improve computation for struggling students and identified several effective instructional strategies. Most of the suggested strategies related to providing drill and practice experiences to improve fluency. Researchers used a meta-analytic study to evaluate skill by treatment intervention for second through sixth grade students from 17 studies and analyzed whether modeling and immediate feedback worked better than novel practice and feedback strategies. The results of digit-per-minute tests used to measure progress in the studies indicated that acquisition interventions (modeling and immediate feedback) worked better for students at frustration levels as opposed to instructional levels (Burns, Coddling, Boice, & Lukito, 2010). Two additional meta-analytic studies indicated which drill and practice strategies resulted in the greatest growth for struggling students. Coddling, Burns, and Lukito's (2011) analysis of 17 single-case experiments determined that drill and practice interventions that incorporated baseline data, drill, and practice with modeling, and a combination of student self-management and teacher tutoring resulted in the greatest fluency growth for struggling first through sixth grade students.

Methe, Kilgus, Neiman and Riley Tillman's (2012) meta-analysis indicated that contingent reinforcement using rewards, speed-based practice, and concrete, visual, and abstract interventions produced the strongest effect sizes for younger students. Methe et al. suggested that educators consider options for upper elementary struggling students who displayed non-responsiveness behavior to drill and practice interventions in the study. Results of Methe et al.'s study also indicated that using a combination of drill and practice strategies resulted in weaker effects, which conflicted with Coddling et al.'s

(2011) findings. Educators should conduct more research using a combination of drill and practice strategies to clarify the effectiveness of practice in improving mathematics performance for struggling students and testing computational instructional strategies on performance of older at-risk students.

Researchers suggested that when teachers analyze baseline data and progress students perform better on tests (Coddling et al., 2011). The Response to Intervention (RtI) process helps teachers assess student progress, identify problematic issues, and plan target intervention strategies (Lembke, Hampton, & Beyers, 2012; Pool, Carter, Johnson, & Carter, 2012). Lembke et al. (2012) investigated how mathematics RtI might compare and contrast to successful RtI reading programs to assess the impact of RtI on mathematics performance of struggling students. Results indicated that level one whole class interventions should include differentiated instruction, peer tutoring, and progress screening (Lembke et al., 2012). Lembke et al. suggested that level two interventions should use supplementary, small group lessons. The lessons should occur four to five times a week and should use explicit, research proven strategies such as modeling, guided instruction, corrective feedback, and repeated practice.

Pool et al. (2012) conducted a case study on third grade tier two students and found that four times a week intervention using a researched proven program called *VMath* improved struggling students' performance in problem-solving and computation. Pool et al. attributed the gains in improvement to the RtI process that involved collaborative efforts to analyze student data, data presentation methods to graph progress, and student rewards based on progress. The baseline data decision-making steps central

to the RtI process resulted in improved student performance on target computational deficits.

An experiment conducted with seventh grade struggling students indicated that incremental rehearsal drill intervention that alternates known and unknown facts within a series of sets improved mastery of unknown facts for the seven students in the study (Coddling et al., 2010). The students gained and maintained acquisition of two facts per session indicating that incremental rehearsal drill intervention improved accuracy and fluency of target skills for struggling students (Coddling et al., 2010). Poncy, Skinner, and Axtell (2010) conducted a multiple probe-across problem-sets study to evaluate the effectiveness of detect, practice, and repair processes on improving digits per minute for third grade students struggling in multiplication. The detect, practice, and repair process increased digits per minute fluency from an average of 20 digits per minute before the intervention to 33 correct facts after the copy, cover, compare intervention.

A multiple-baseline across tasks design was conducted to test the effects of taped drill and practice on digits per minute for second grade students (Windingstad, Skinner, Rowland, Cardin, & Fearington, 2009). The taped intervention procedure required students to try to write the answer to the fact before the audio recording read the answer. Results indicated that the fast-paced game approach enabled students to increase speed by an average of 11 digits per minute after the taped problem intervention (Windingstad et al., 2009). Survey data indicated that students believed the intervention helped improve fluency, and teachers enjoyed the ease of implementing the program (Windingstad et al., 2009).

Another experiment tested the effectiveness of a self-administered folding-in technique on fluency (Hulac, Wickerd, & Vining, 2013). The fourth and fifth grade remedial students improved in the independent phase of the intervention but indicated greater gains with the addition of 15 minutes per week of adult monitoring (Hulac et al., 2013). The combination of independent practice and teacher feedback provided optimal conditions for improving fluency (Hulac et al., 2013). A randomized control study designed to examine the effects of a supplemental fluency-building intervention on mathematic performance indicated a 61% reduction in computational learning issues for the intervention group (VanDerHeyden, McLaughlin, Algina, & Snyder, 2012). The teachers matched the low and high functioning fourth and fifth grade students during the intervention, which resulted in a higher effect size for students with lower baseline data (VanDerHeyden et al., 2012). Researchers revealed that the effectiveness of the drill and practice programs related to modeling, student self-management, immediate feedback, peer tutoring, and fast-paced aspects of the intervention strategy (Coddling et al., 2011; Poncy et al., 2010; Windingstad et al., 2009).

Current research results have indicated strong agreement in using a drill and practice approach to improve computational fluency. Drill and practice programs used baseline data to determine the instructional content for each student, which supported Vygotsky's (1978) concept of using scaffolding in instruction for students in the zone of proximal development. The modeling, peer tutoring, and targeted practice aspects of drill and practice programs allowed teachers to reach students during the zone of proximal development.

Researchers also suggested ways for educators to improve conceptual understanding. An experiment conducted to determine if using real-life problem-solving questions improved math performance for third grade Hungarian students resulted in improved computational performance for the treatment group (Csíkos et al., 2012). Csíkos et al. (2012) concluded that selecting word problems with realistic content helped in developing arithmetic skills of students without using a drill and practice approach. The students gained a better understanding of numbers through the real-life activity, which made computational process meaningful (Csíkos et al., 2012). Bottge, Grant, et al. (2010) confirmed the effectiveness of using word problems to improve computational skills through an experiment that tested the effectiveness of computer-embedded lessons. The students in the embedded word problem group improved computational skills. Researchers believed that the integrated problem-solving and computational experiences helped struggling students perform better because the integration of mathematical concepts helped students establish relationships between mathematical concepts and real-world situations (Bottge, Rueda, et al., 2010).

David and Tomaz (2012) improved conceptual understanding of computational processes by using drawings. The case study results of fifth grade students indicated that presenting irregular drawings with information that contradicted algorithm procedures helped students to understand that computational procedures had contexts that determined when and how to apply algorithmic procedures. Drawing representations helped students gain an understanding of theories behind the algorithmic processes, which reduced reliance on memorized processes (David & Tomaz, 2012). The strategies of using the

real-life word problems and drawings helped students to see meaning behind mathematical processes, which improved computational performance for struggling students.

Kolb's (1984) stated importance of integrating multiple teaching approaches to meet diverse learning needs of students in the experimental learning theory. Research findings indicated that teachers should integrate real-life experiences with school-based instruction and problem-solving with computational instruction and visual representations, which supported the major beliefs behind the converging learning theory.

Based on the positive results of the drill and practice research, I focused on understanding teachers' perceptions about implementing drill and practice programs to improve computational performance of basic skills students. In the study, I determined if teachers had knowledge about drill and practice programs for middle school students, currently used drill and practice programs, and encountered challenges when using drill and practice. I also investigated teachers' use in incorporating data analysis procedures, teacher feedback, and peer tutoring when incorporating drill and practice programs. The review of research did not yield studies related to teacher preparedness to implement drill and practice programs; therefore, I investigated teachers' knowledge about drill and practice programs, accessibility of drill and practice programs, and teachers' perceptions about the feasibility of implementing a drill and practice program into the regular classroom environment.

Number sense. An analysis of research on number sense indicated a link between poor achievement and poor number sense (Geary et al., 2011; Hecht & Vagi,

2010; Mazocco & Devlin, 2008; Sengul & Gulbağci, 2012; Yang & Li, 2008). An experiment conducted to document growth rates in number processing skills indicated that fifth grade low-achieving students scored one to two years below typical achieving students on number sense procedural tasks (Geary et al., 2011). The study indicated that students demonstrated deficiencies in committing facts to long-term memory (Geary et al., 2011). Sengul and Gulbağci (2012) designed a mixed-methods study to examine students' number sense of decimals using interview and testing data. Data indicated a decimal number-sense deficiency for sixth through eighth grade students from Turkey due to students' persistent reliance on rule-based strategies and lack of conceptual understanding of the meaning of decimal numbers (Sengul & Gulbağci, 2012). Hecht and Vagi's (2010) conducted a longitudinal study and confirmed a lack of conceptual understanding of numbers as results of the study indicated that fifth grade low-achieving students lacked an understanding of the part-whole relationship of fractions as compared to typical-achieving students. Yang and Li's (2008) conducted a study to investigate the number sense of third graders and found that 40% of the students could not identify part-whole relationships and that 60% could not compare rational numbers.

Mazocco and Devlin's (2008) longitudinal study and also compared number sense performance of typical and low-achieving sixth through eighth grade students and found that low-achieving students struggled to rank rational numbers, find equivalent number forms, and read decimals, mostly due to a lack of understanding about the quantities that rational numbers represent (Mazocco & Devlin, 2008). Researchers also determined that students struggled to judge the reasonableness of numbers the most

(Sengul & Gulbagic, 2012; Yang & Li, 2008). A significant finding from the Sengul and Gulbagic (2012) study indicated that poor teacher knowledge contributed to poor student number sense performance. Sengul and Gulbagic explained that teachers lacked number sense, so teachers avoided including number sense lessons in instruction.

Key findings in research on number sense abilities indicated that students demonstrated deficits in long-term memory retrieval, understanding of rational numbers, a sense of the magnitude of numbers, and the reasonableness of numbers. Researchers believe that the issues stem from the abstract nature of number sense concepts. Educators will need to develop concrete and representational lessons to help diverging and accommodating learners understand number sense concepts. Educators will also need to determine the zone of proximal development for struggling students and provide scaffolding approaches to help students reach a level of maturity in number sense concepts.

Current researchers investigated the effectiveness of two number sense instructional strategies. Powell and Fuchs (2012) designed an experiment to determine if the *Galaxy Math Program* would improve number knowledge of first grade at-risk students. Students in the intervention group received either 15 minutes of number sense practice or 5 minutes of number-sense game practice daily. The students in the *Galaxy Math Program* group made larger gains in number-sense performance than the control group. Results indicated that explicit instruction that blended conceptual and procedural knowledge and included frequent practice provided the best intervention for developing number sense ability (Powell & Fuchs, 2012).

White (2009) developed a quantitative study to test the effectiveness of the *Count On Program* in preparing educators to teach number sense concepts to struggling middle school math students. Teachers participated in a 10-week training professional development program. Students' place value scores improved after teacher intervention. Place value questions tested students' ability to understand the magnitude of numbers, which related to number sense. Participation in professional development enhanced teachers' knowledge about place value and improved teachers' understanding about number sense, which improved student performance (White, 2009). The limited amount of research on the topic of number sense indicated an importance in developing explicit, conceptual, and procedural instruction that included frequent practice to enhance number sense abilities in struggling students. The blended approach to teaching number sense related to Kolb's (1984) theory on accommodating multiple learning styles through abstract, concrete, and reflective processes. The limited research in number sense may relate to the fact that educators find it difficult to define or understand a definition of number sense due to the abstract nature of number sense and the fact that number sense concepts connect to other mathematical areas (Sengul & Gulbağci, 2012). Sengul & Gulbağci related number sense to common sense and described number sense as difficult to see or characterize. Educators, therefore, need to continue to conduct research on number sense to provide clear explanations of number sense and evidence for other effective number sense instructional strategies.

Based on the research that resulted in positive gains in student number sense, I aimed to investigate teachers' perceptions about what causes students to struggle with

number sense to see if teachers agree with the current research that points to reliance on rule-based strategies, inability to judge reasonableness of numbers, and lack of understanding of rational numbers. I also investigated teachers' experiences with blending conceptual and procedural instructional strategies to improve number sense of basic skills students. Current research results indicated that teachers lacked an understanding of number sense but provided limited results revealing teachers' perceptions about teacher understanding of number sense; therefore, I also focused on determining the teachers' understanding of number sense and comfort level in teaching number sense concepts.

Cognitive Processes

Cognition refers to the process of thinking. Cognitive processes required to engage in thinking include obtaining, processing, storing, and applying information. Short-term, long-term, and working memory work together to conduct the tasks required for thinking. Teachers identified poor working memory as an issue for struggling students. Current research results indicated several issues with working memory that related to poor mathematical performance.

Researchers described working memory as a cognitive function responsible for processing and storing information in a readily accessible state for short-term use (Lee et al., 2011). Researchers revealed four components of working memory that affected learning: phonological loop, episodic buffer, central executive function, and the visuo-spatial representation system (Geary, 2011). The central executive function identifies relevant information and stores the information in the working memory. The

phonological loop and visuo-spatial sketchpad make up the central executive function. The phonological loop processes language and the visuo-spatial sketchpad processes visual and spatial information. The episodic buffer integrates the language, visual, and spatial information. Geary (2011) found that the phonological loop is a better predictor of reading achievement and the visuo-spatial sketchpad is a better predictor of mathematics achievement. The components of working memory function together, but a deficit in one area does not automatically translate to an issue with another component (Passolunghi & Cornoldi, 2008). Research studies indicated that specific working memory impairments partially explained poor mathematic performance. Berg and Hutchinson (2010) conducted a quantitative study to determine if processing speed, short-term memory, and working memory accounted for learning differences of at-risk mathematics students. The testing data indicated that poor performance in mental arithmetic related to the interaction between working and long-term memory functions, and at-risk students struggled to hold new information while performing other steps in a problem (Berg & Hutchinson, 2010).

Witt (2010) also found that struggling students have issues with storing multiple pieces of information in working memory. The experiment to explore relationships between arithmetic and working memory indicated that students who performed poorly in multiplication tasks demonstrated impairments in central executive function of the working memory (Witt, 2010). The fifth grade students struggled to ignore unwanted information stored in working memory, which affected accuracy when multiplying numbers (Witt, 2010). Berends and van Lieshout's (2009) mixed design study to

compare the accuracy and speed of students with good and poor calculating skills indicated that poor calculators struggled to sort through useless versus helpful information in the working memory. Berends and van Lieshout used illustrations with varying levels of usefulness to examine how low-achieving students processed information. Fifth grade struggling Dutch students performed poorly on problems accompanied by illustrations (Berends & van Lieshout, 2009). The researchers concluded that it took students longer to solve illustrated problems and accuracy dropped because the thinking process involved judging the value of information, which increased the level of working memory load (Berends & van Lieshout, 2009).

Passolunghi and Cornoldi (2008) introduced the idea of passive and active aspects of working memory. Passolunghi and Cornoldi conducted a quantitative study to determine the relationship between working memory and calculation abilities of fifth grade Italian students. Students with poor arithmetic ability scored significantly lower on problems that required multiplication of novel information but not on tasks that required recall of information in similar formats or word processing tasks (Passolunghi & Cornoldi, 2008). The researcher further confirmed the relationship between working memory and arithmetic achievement but also introduced the idea that working memory used the central executive function to sort information into active and passive categories when processing. Active information required the working memory to apply information to new situations and passive working memory required the working memory to follow rote processes (Passlounghi & Cornoldi, 2008). The results indicated that weaknesses in

active working memory do not translate to weaknesses in passive working memory (Passolunghi & Cornolodi, 2008).

Geary (2011) conducted an experiment to understand the contributions of number counting competence and arithmetic in first through fifth grade students while controlling for intelligence, working memory, and processing speed. The researcher used a battery of cognition, intelligence, and achievement tests to measure number counting and cognitive functioning. The results indicated that working memory and processing speed predicted mathematics performance more than intelligence and provided valuable evidence about how each component of working memory affected learning (Geary, 2011). Central executive function and visuo-spatial systems both predicted mathematics performance and the students used the central executive function more often as tasks advanced (Geary, 2011). The study indicated that students who struggled with arithmetic had deficits in the working memory areas of central executive function and the visuo-spatial system.

Passolunghi and Mammarella (2010) conducted an experiment to determine the role of visuo-spatial working memory in the process of problem-solving. The researchers compared the performance of fourth grade typical-achieving to low-achieving Italian students. The results of a battery of academic and cognition assessments indicated that low-achieving students performed lower in the backward Corsi block and pathway span working memory tasks that measured spatial ability than the house recognition task that measured visual ability. Passolunghi and Mammarella (2010) concluded that poor performance in problem-solving tasks related to spatial working memory deficits and not

visual deficits. The results indicated that the use of spatial schematic imagery improved problem-solving performance, which suggested that teachers should train students on how to use spatial representations when solving mathematical problems.

Swanson, Jerman, and Zheng (2008) examined working memory to determine what components influenced problem-solving performance. The researchers conducted a longitudinal study to examine results from a battery of problem-solving, achievement, and cognitive tests administered to first, second, and third grade students across three waves of testing. Results indicated that phonological loop, visual-spatial sketchpad, and central executive components of working memory accounted for 36% of the variance in problem-solving performance (Swanson et al., 2008). Students in the study, therefore, struggled with a combination of language, visual- spatial, and identifying relevant information skills when processing mathematical word problems. Further analysis indicated that the central executive component accounted for 27% of the total variance in problem-solving performance, which meant that phonological loop and visual-spatial sketchpad combined accounted for 9% of the variance (Swanson et al., 2008). The executive component of working memory influenced problem-solving performance over the three-year span more than other working memory components (Swanson et al., 2008). The results indicated that at-risk students displayed lower performance and less growth rates as a result of deficits in working memory components (Swanson et al., 2008).

When students use of working memory effectively, students update information to refresh active memory with new information (Lee et al., 2011). Lee et al. (2011) conducted a longitudinal study to determine if updating processes mediated pattern,

computational, and algebra relationships. The results from the battery of tests given to fourth and fifth grade students from Singapore indicated that updating explained a significant amount of the variance in computational performance (Lee et al., 2011). Researchers found that updating accounted for 68.4% of the variance in algebra proficiency and 84.8% of the variance in algebra problem-solving (Lee et al., 2011). Iuculano, Moro, and Butterworth's (2011) quantitative study to determine if updating tasks affected arithmetic abilities and difficulties in working memory indicated that third grade struggling students displayed deficits in addition accuracy and speed, but not in working memory tasks. Iuculano et al. (2011) failed to make a connection between updating and arithmetic; therefore, educators should conduct more research to confirm or disprove the results of the updating studies.

An analysis of research also indicated that deficits in working memory did not account for the total variance in performance of typical-achieving and low-achieving students. Hecht and Vagi's (2010) two-year longitudinal study to compare fourth and fifth grade fraction performance of students with varying abilities indicated that typical and low-achieving students perform poorly on working memory tasks consistently. Low-achieving students averaged approximately two points lower on working memory tasks than typical-achieving students (Hecht & Vagi, 2010). The results of the battery of tests indicated that working memory abilities contributed to growth in fraction performance but did not explain the differences in fraction performance between typical and low-achieving students. The results indicated that working memory accounted for 49% of the variance in computation and 62% of the variance in problem-solving performance;

however, ability accounted for 0% of the variance in both areas. Results of the study indicated that working memory deficits impacted performance of struggling students, but other factors also contributed to the complex issue of underachievement in mathematics.

Vygotsky's (1978) social development theory connected to issues surrounding working memory. Researchers suggested that deficits in working memory related to retrieving information from long-term memory, storing information in working memory, and evaluating the effectiveness of information stored in the working memory. The results of studies indicated that deficits in the central executive and visual-spatial system of the working memory prohibited students from calculating accurately and solving complex problems. Educators need to understand the zone of proximal development for each student's working memory to design instruction to target individual working memory needs.

Based on research findings, low achieving mathematics students struggle with deficits in visuo-spatial sketchpad and central executive functions of the working memory. Researchers suggested that students struggled to process information when problems contained irrelevant information and required multiple steps, and when students had to apply information to new situations. Teachers at the middle school under study identified working memory as an issue for struggling mathematics students; therefore, I focused on investigating the teachers' understanding of working memory and explanations about why students struggle with working memory in mathematics. Current researchers focused more on issues related to active memory and applying new information; yet research on the topic of computation indicated that remedial students

struggle to recall basic facts. I also focused on understanding teachers' perceptions about basic skills students' ability to use passive memory to follow rote processes and recall basic facts.

Instructional strategies. Researchers also provided evidence of effective instructional strategies for overcoming working memory deficits. Geary's (2011) study on the contributions of number counting competence in arithmetic performance indicated that students who developed working memory deficits in first grade continued to struggle with working memory deficits in later years. Geary suggested that early arithmetic skills predicted mathematics performance more than domain general abilities, so educators need to develop early detection systems for identifying working memory issues and arithmetic intervention strategies to overcome the consequences of working memory issues.

Fyfe, Rittle-Johnson, and DeCaro (2012) suggested using outcome and strategy feedback to overcome the consequences of poor working memory. Fyfe et al. (2012) conducted an experiment to examine how feedback affected mathematics performance. The results indicated that struggling students with lower procedural and conceptual knowledge benefitted from feedback related to mathematics thinking. Students in the intervention group performed 14% better on procedural and 17% better on conceptual problems than the control group. Fyfe et al. suggested that the feedback helped reduce the working memory load of struggling students.

Kapur's (2011) quasi-experiment to determine how productive failure lessons affected learning for seventh grade students indicated that the intervention improved

mathematics performance because productive failure instruction activated prior knowledge, which helped struggling students reduce working memory overload. Students in the productive failure intervention averaged approximately four points higher ($M = 27.21$) than the lecture ($M = 23$) and complex problem-solving ($M = 23.77$) instructional groups. The researcher described the results as a statistically significant multivariate effect of condition on posttest scores, $F(8, 202) = 3.18, p = 0.002$. Witt's (2010) study that explored the relationship between working memory and arithmetic indicated that students with weak phonological loop abilities performed poorly in multiplication fluency because of the need to recall information from long-term memory. Witt suggested educators help students with weak phonological loop abilities by reducing the need to recall or use rote processes in multiplication. Educators need to teach students with phonological loop weaknesses to use recording steps to reduce working memory load (Witt, 2010). Windsor (2011) conducted a study to determine how algebra thinking developed as a result of experience, discussion, and interpretation of problems. Teachers implemented the use of counters and calculators as seventh grade students solved algebra problems. The researchers revealed that students who used counters and calculators performed better because the extra resources alleviated cognitive load in the working memory (Windsor, 2011). Researchers suggested that by reducing working memory load students were able to focus attention on generating solutions to mathematical problems instead of processing information, which improved performance (Windsor, 2011).

Elliott, Gathercole, Alloway, Holmes, and Kirkwood (2010) conducted a quasi-experiment to determine if improving teacher quality affected working memory. The teacher-training program focused on making teachers more aware of instructional adaptations to overcome working memory issues and provided direct instruction training. The interventions did not improve first and third grade student performance (Elliott et al., 2010). Direct instruction and teacher awareness interventions failed to improve working memory abilities. Awareness training staff encouraged teachers to repeat information frequently and use memory aids, which teachers naturally did anyway. The redundant training may have affected the results of the study.

Vygotsky's (1978) social development theory related the research on using instructional strategies to improve working memory. Research suggested that providing feedback, opportunities for productive failure, and modification to reduce cognitive load helped students compensate for working memory issues. These strategies provided scaffolding experiences that helped students develop knowledge and skills at individualized paces. Kolb's (1984) experiential learning theory also related to research on working memory in that many of the strategies used to reduce cognitive load, such as using manipulatives and creating logical procedural steps, tapped into different learning styles. Research results on teacher-training programs that are designed to improve working memory awareness conflicted with other research results that proved the effectiveness of teacher-training programs in improving mathematics performance. Educators should continue to conduct research to evaluate how teacher-training programs affect working memory performance.

Based on the current research results, researchers suggested teachers improve working memory performance by findings ways to reduce the load placed on the working memory; therefore, I focused on understanding the strategies teachers employ to help basic skills students retain, recall, and apply mathematical procedures. I also aimed to investigate teachers' perceptions about using feedback, activating prior knowledge, and providing step-by-step instructions to improve students' ability to process information. The current literature review indicated that the use of counters and calculators reduced working memory load for students; however, the research did not test other manipulative resources. I focused on understanding the teachers' experiences in using various manipulatives during mathematics instruction with basic skills students. Researchers discussed the impact of teacher training in working memory strategies on student mathematics performance and found no correlation. Based on the limited research in this topic, I focused on examining teacher beliefs about teacher preparation in designing lessons to enhance working memory function of basic skills students.

Psychological Factors

Abraham Maslow (1943) developed a theory about motivation and described five human basic needs that drive behavior and motivation. Although these needs were related, Maslow explained a hierarchical relationship between them with physiological needs taking priority over all other needs. Maslow identified safety as the second priority. Next, people strive for love, which manifests itself as affection and belonging

(Maslow, 1943). The fourth priority relates to the need for esteem, described by Maslow as displaying a stable self-concept, strength, achievement, adequacy, and confidence. Maslow described the last priority as the need for self-actualization, further defined as the need to feel purpose and self-fulfillment in life to be happy. Maslow's theory on motivation informed the study of mathematics achievement because teachers identified self-efficacy as a barrier for basic skills students. Since self-actualization, belonging, and self-esteem develop a sense of self-efficacy, teachers need to understand how to meet self-efficacy needs in an educational setting. I, therefore, designed the study to help uncover how to design instructional lessons to meet students' basic self-efficacy needs.

Psychological factors. Researchers revealed multiple psychological factors that influenced mathematics learning for students that related to emotional, social, and motivational issues. Researchers demonstrated that learning experiences that allowed students to develop psychological attributes such as self-efficacy, self-esteem, and affirmation associated with increased mathematics performance. For example, Ayotola and Adedeji (2009) examined how gender, age, mental ability, anxiety, and self-efficacy predicted mathematics performance for middle school and high school students. Ayotola and Adedeji administered a mental ability, mathematics anxiety, and mathematics self-efficacy questionnaire and a mathematics achievement test. The data indicated that self-efficacy accounted for 13.8% of the variance in mathematics performance and that gender and anxiety also associated with mathematics performance.

A correlational study conducted to determine the effects of school, class, and student level variables on first through sixth grade mathematics achievement also

indicated that self-efficacy predicted performance (effect size = 0.12) but indicated that age and metacognitive ability (effect size = 0.51) influenced mathematics performance more than self-efficacy (Zhao et al., 2011). Ocak and Yamaç (2013) used a relational screening model to examine the predictive effects of cognition, metacognition, self-regulation, and attitude on achievement and found that the combined factors explained 58% of the variance in mathematics performance. Results also indicated that self-efficacy accounted for 57% of the variance in cognition and 56% of the variance in metacognitive performance. Self-esteem levels predicted fifth grade mathematics achievement and improved metacognitive abilities; however, self-efficacy did not account for the total variance or rank as the strongest predictor consistently (Ocak & Yamaç, 2013).

Current researchers revealed conflicting results regarding the link between self-efficacy and gender. Louis and Mistele (2011) conducted a cross-sectional non-experimental study using public data from the *Trends in International Mathematics and Science Study* (2007) to explore relationships between gender, self-efficacy, and mathematics performance. Data indicated that male students ($M = 2.41$) demonstrated higher self-efficacy than female students ($M = 2.18$), but the difference in self-efficacy did not correlate to differences in mathematics achievement (Louis & Mistele, 2011). Segnodan and Iksan (2012) also found that male students ($M = 27.60$) scored higher on self-efficacy measures than female students ($M = 27.50$). The researcher conducted a correlational study to determine if learning style influenced mathematics learning for youth. Results of the questionnaire indicated that the higher-functioning students

displayed significantly high levels of confidence ($M = 29.07$) in beliefs about performance and displayed strong effort ($M = 27.13$) when solving difficult mathematic tasks (Segnodan & Iksan, 2012). In contrast, students with low self-efficacy displayed stress and depression when presented with a difficult mathematical task (Ocak & Yamaç, 2013). Ocak and Yamaç (2013) did not present the means for self-efficacy for the study, but structural equation modeling processes demonstrated that self-efficacy predicted achievement in a positive way ($r = 0.60$) and test anxiety predicted achievement in a negative way ($r = -0.12$). Together, self-efficacy and test anxiety accounted for 41% of the variance in achievement. Ocak and Yamaç studied the relationship between fifth grade motivation, cognition, metacognition, student-regulated learning, attention, and achievement and indicated that students with low self-efficacy avoided mathematical work, expended less effort, and gave up in solving difficult mathematical problems. Levpuscek and Zupancic (2009) found an inverse relationship between self-efficacy and achievement as results from the qualitative inventories indicated that low achievement contributed to low self-efficacy.

Amirali (2010) used a quantitative survey design to understand eighth grade Pakistani student perceptions and attitudes toward mathematics. The researcher reported different results than Louis and Mistele (2011) it that the findings indicated no gender differences in self-efficacy levels. In fact, the data indicated that 70% of the students felt confident in solving mathematics problems, and 59% of the students thought the mathematics was easy to learn (Amirali, 2010). The results did reveal a gender discrepancy in anxiety though, which closely related to self-efficacy. The eighth grade

female students displayed less anxiety than male students (Amirali, 2010). Research indicated a gender gap in self-efficacy; however, researchers failed to develop a consistent link between low self-efficacy and low performance. Amirali researched Pakistani students while Louis and Mistele researched students within multiple cultures; therefore, culture may impact self-efficacy levels of different genders and ethnic groups.

Research results indicated pointed to a possible relationship between self-efficacy and effort. Phillipson's (2010) quantitative study on understanding how parental values influenced cognitive ability and mathematics achievement for fifth and sixth grade Japanese students indicated that parental influence explained 58% of mathematics achievement in the study. The questionnaire data indicated a correlation between mathematics achievement, parental involvement, and effort with an effect size of 0.71 (Phillipson, 2010). Parents that believed effort determined mathematics performance displayed more involvement with students (Phillipson, 2010). Higher positive parental support levels linked to higher student self-efficacy and achievement (Phillipson, 2010), but parental pressure correlated with low self-efficacy with a beta coefficient of -0.23 (Levpusek & Zupancic, 2009). Levpusek and Zupancic (2009) conducted a qualitative study to explore eighth grade Slovenian students' perception about the link between teacher and parent support and achievement and identified parent pressure as the strongest predictor of low self-efficacy and achievement. The researchers found that parents who put pressure on low-achieving students to achieve displayed distrust, dissatisfaction, criticism, and unrealistic expectations, which caused students to develop negative self-esteem (Levpusek & Zupancic, 2009). Research indicated that parental

beliefs about the relationship between effort and performance determined the nature of parental involvement, which influenced self-efficacy.

Teacher beliefs about student performance also influenced self-efficacy and mathematics performance. The inventory data from Levpuscek and Zupancic's study (2009) indicated that teacher factors predicted mathematics performance more than parent factors. The researchers found that teachers who pressed students to achieve goals and promoted improvement in learning improved student self-efficacy. Improvement in self-efficacy beta coefficients ranged from 0.05 to 0.40 (Levpuscek & Zupancic, 2009). The students' belief that teachers cared about student progress led to gains in student achievement (Levpuscek & Zupancic, 2009).

The correlational study conducted by Erden and Akgü (2010) indicated a link between teacher support to math anxiety, and the researchers found that the two variables explained 43% of the variance in mathematics performance. The researchers discovered an inverse relationship between math anxiety and achievement and a positive relationship between teacher support and mathematics achievement (Erden & Akgü, 2010). The stress caused by difficult tasks led to anxious feelings and caused students with low self-efficacy to avoid tasks (Ocak & Yamaç, 2013). Erden and Akgü suggested that teachers could improve student self-efficacy by avoiding anxiety-provoking behaviors such as negative speech and vague feedback. Kesici, Erdoğan, and Kekesoglu (2010) conducted a study to investigate how motivation and self-esteem related to math anxiety for middle school students by using a "Mathematics Anxiety Rating Scale," an "Achievement Motivation Scale," and a "Social Comparison Scale." The results of the study indicated

that high math anxiety levels developed for students who displayed high motivation or low self-esteem. Using Cohen's d , the researchers found a medium effect size ($d = .52$) when considering the effect that motivation level had on student anxiety levels and a large effect size ($d = .95$) when assessing the effect that self-esteem had on anxiety levels (Kesici et al., 2010).

Results from the studies informed mathematics instruction for basic skills students because the results indicated significant factors contributing to low self-efficacy. Researchers revealed that anxiety and parental pressure affected self-efficacy levels negatively and teacher involvement affected self-efficacy levels positively. Low self-efficacy levels led to reduced effort and depression.

Researchers identified several factors that correlated with self-efficacy in mathematics. I focused on examining teachers' beliefs about the self-efficacy levels of basic skills students and what affects self-efficacy levels. I aimed to determine if teachers agree with current literature in that confidence levels, anxiety, effort, low achievement, parent support, and teacher support contribute to self-efficacy levels and to provide teachers with the opportunity to identify other factors that affect the self-efficacy levels of basic skills students at the middle school under study. Research studies did not link learning style to self-efficacy levels of mathematics students. Based on the fact that some learning styles connect naturally to the logical and spatial aspects of mathematics topics (Gardner, 2006), I aimed to understand teachers' perceptions about a possible link between self-efficacy and learning styles.

Instructional strategies. Current researchers provided evidence to suggest effective instructional strategies for improving student self-efficacy and mathematics performance. Carolan et al. (2013) conducted a longitudinal study to examine how specific mechanisms affected middle school achievement. The researcher collected data from the ECLS-K Mathematics Assessment and Teacher Questionnaires. The data indicated that classroom quality, which consisted of rigorous approaches, academic standards, excellent behavior, and extensive instructional time, as the biggest predictors of mathematics performance. The combination, however, of instructional support, climate, motivation, teacher beliefs, efficacy, and expectations predicted performance most accurately (Carolan et al., 2013).

Beecher and Sweeny (2008) conducted a study to investigate how enrichment-based, differentiated activities across all content areas affected achievement gaps among socioeconomic status and ethnic groups in an elementary school. The researcher used information from meeting agendas, strategic plans, professional-development sessions, curriculum documents, and test score data to examine the effects of enrichment and differentiated approaches on student performance. Results from the document and standardized test analysis indicated that when students developed positive attitudes toward learning and attributed learning success to internal factors and failures to external factors, self-efficacy and mathematics performance increased for students (Beecher & Sweeny, 2008). The researcher defined positive student attitudes as having a sense of curiosity, energy, and excitement toward learning (Beecher & Sweeny, 2008). Positive

atmospheric factors in a learning activity satisfied the students' need for self-esteem; thus, allowed students to focus on learning.

Dawes and Larson (2011) also investigated how social psychological factors impacted academic learning by examining what factors influenced psychological engagement and motivation in youth enrolled in leadership and arts programs. The researcher conducted longitudinal interviews, and results indicated that 86% of the students noted that motivation increased when activities required students to make personal connections to future career goals, build personal affirmation, or transcend self-interest to make a contribution to society (Dawes & Larson, 2011). The study informed the work on mathematics instruction for remedial students by providing teachers with ideas for motivating mathematics students.

Sakshaug and Wohlhuter (2010) confirmed the effectiveness of leadership in establishing self-efficacy by conducting an action research study. Teachers reported that the problem-solving approach to teaching mathematics improved student attitude, enthusiasm, and achievement as traditionally unmotivated weaker students took on leadership roles (Sakshaug & Wohlhuter, 2010). The researchers believed group work involved in the problem-solving approach provided comfort and confidence for struggling mathematics students (Sakshaug & Wohlhuter, 2010). Instructional activities that engaged students in meaningful problem-solving tasks, incorporated cooperative learning, and provided leadership opportunities positively impacted self-efficacy levels.

Researchers also found that motivational factors influenced learning. Gurland and Glowacky (2011) conducted a study to investigate middle school students'

perceptions about motivation. The researcher collected the data through a “Children’s Lay Theories of Motivation” questionnaire, “Self-Regulation Questionnaire,” and “Autonomy Support Questionnaire.” The majority of students identified rewards and personal choice as the most motivating factors, which contradicted previous research that suggested that real-life relevance created the best motivation (Gurland & Glowacky, 2011). Results indicated a mean score of 2.91 (mean scores ranged from 2.36 to 2.39) for students who preferred rewards. Gurland and Glowacky (2011) defined personal choice as allowing students to choose instructional activities based on interests and values (Gurland & Glowacky, 2011). The “Self-Regulation Questionnaire” measured students’ preference toward extrinsic, introjected, identified, and intrinsic rewards. The majority of students preferred extrinsic rewards (Gurland & Glowacky, 2011). When teachers rewarded students, the students benefitted from knowing the feeling of adequacy; thus, meeting the need for self-esteem. Researchers suggested that mathematics teachers should incorporate extrinsic reward systems and provide opportunities where students have choices.

Researchers found that positive corrective feedback provided by computerized software motivated students and improved self-efficacy levels. Wei, Hung, Lee, and Chen (2011) developed a mixed methods study to evaluate the effects of *LEGO MINDSTORM NXT* program on second grade mathematics learning. The questionnaire results indicated that 90% of students in the experimental group felt happy and engaged in risk-taking behaviors when the robot provided positive feedback and praise for correct answers (Wei et al., 2011). The students in the control group experienced that a level of

discomfort when solving problems on the blackboard (Wei et al., 2011). Comfort level affected self-efficacy, so students involved with positive corrective feedback when the robot responded to student answers with actions and sounds seemed to display a higher level of self-efficacy.

Moss and Honkomp (2011) used a motivation and content knowledge questionnaire and conducted interviews to determine how adventure learning affected motivation and learning for middle school students in the area of social studies. Moss and Honkomp defined adventure learning as online learning environments that allow students opportunities to engage in solving authentic problems. Teachers' structured adventure-learning activities through a hybrid approach where curriculum-based educational activities in the classroom linked to researchers experiences in the real world (Moss & Honkomp, 2011). Students worked with other students, experts, teachers, and subject matter experts online to pose questions, analyze data, and take action to solve problems in their communities. Adventure learning experiences increased motivation (from a mean of 5.79 to 5.83) and self-efficacy (from a mean of 4.48 to 5.44) as the activity allowed students to gain a sense of competence, relatedness, and autonomy as measured by comparing pretest and posttest responses (Moss & Honkomp, 2011). The increases in self-efficacy and motivation were statistically significant. By engaging in Personal connections, interesting problems, and the feeling of competence and autonomy students see purpose in learning, which meets the need for self-actualization (Moss & Honkomp, 2011). These aspects of learning apply to all subject areas including

mathematics; therefore, the study informs the work related to understanding mathematics performance of remedial mathematics students.

Researchers found a link between self-regulation, goal setting, high expectations and motivation. Lui, Cheng, Chen, and Wu (2009) conducted a study to determine the long-term effects of educational expectations and achievement attributions on academic development for junior and high school students. An analysis of publically released files from the Taiwan Educational Panel Survey ability test and questionnaire data from 2001-2007 indicated that students who set low expectations performed lower on achievement tests (Lui et al., 2009). The performance of students who set low expectations ranged from a mean of 0.22 to 1.33 while students who set high expectations ranged from a mean of 1.59 to 2.38. Metallidou and Vlachou (2010) conducted a quantitative survey to study how self-regulatory learning affected student initiation and control over learning. The results indicated that teachers believed that fifth and sixth grade Greek students who expressed high value toward mathematics engaged in self-regulatory learning by seeking knowledge, setting goals, making plans, and displaying intrinsic motivation. Self-regulated behaviors of students who set high values resulted in high cognitive ability, achievement, and student beliefs about competence (Metallidou & Vlachou, 2010). The teachers rated students with high values with a mean of 17.67 and students with low values with a mean of 14.17 (Metallidou & Vlachou, 2010). Self-regulatory behaviors and high expectations allowed children to develop a sense of confidence, independence, and purpose, which in turn, satisfied the need for self-esteem and self-actualization.

Mathematics students might benefit from the self-efficacy that resulted from goal-setting and self-regulatory learning when engaging in mathematical problem-solving.

Researchers also found that social factors influenced self-efficacy. Slavin et al. (2009) conducted a meta-analysis of experimental studies to determine effective mathematics program characteristics for middle and high school students. Results indicated that cooperative-learning activities improved learning more than textbook or technology-based instruction with an effect size of 0.42 (Slavin et al., 2009). During cooperative learning activities students worked together to complete learning tasks. The students, as a result, felt a sense of cohesiveness. Researchers conferred with results of a seminal study conducted by Strong, Silver, and Robinson (1995), which elicited student input regarding engaging work. Through interview responses, students expressed a preference for work that allowed students to build relationships (Strong et al., 1995). Brown and Beckett (2007) conducted a study to understand the role of parental involvement in student functioning. Through teacher and parent interviews, the researcher corroborated Phillipson's (2010) results with Japanese students discussed previously that positive parental involvement in student academics increased the chance of student success (Brown & Beckett, 2007). Phillipson found that high parental involvement led to high self-efficacy and performance while Brown and Beckett discovered that increased parental involvement improved student behavior and performance. Reasons for results might relate to students' need to feel safe in order to learn, the fact that students viewed parents as protectors, and the fact that students felt loved when parents supported educational efforts (Maslow, 1943). Based on Maslow's

theory (1943), students engaged other people to satisfy the need for love, which created a safe environment for learning and built self-efficacy. The studies about social factors addressed general education; however, social factors affect learning in any subject, including mathematics.

The results of self-efficacy studies informed mathematics instruction for basic skills students because, in each of the studies, learning activities contained elements that met students' need for esteem, which allowed students to direct attention to learning. When students, in contrast, experience anxiety based on unmet needs, the ability to concentrate decreases, making learning more difficult. Anxiety, as a result, negatively impacts math performance (Ayotola & Adedeji, 2009; Kesici et al., 2010). Researchers in mathematics performance affirmed that satisfying students' physiological, safety, love, esteem, and self-actualization needs increased motivation to learn. Researchers found that real-life learning experiences seemed to provide an effective way for addressing mathematics underachievement. Researchers suggested that adventure and community-based instruction proved to be viable instructional strategies for improving problem-solving skills as alternate types of learning provided opportunities for students to engage in real-life learning tasks (Dawes & Larson, 2011; Moss & Honkomp, 2011). Current research indicated that cooperative, differentiated, problem-based, and technology-based learning improved mathematics performance.

Researchers in the area of self-efficacy promoted the concept of improving self-efficacy levels of struggling mathematics students by providing experiences that allowed students to increase levels of competence and purpose. I focused on investigating

teachers' experiences with using strategies to build student confidence levels while solving mathematics problems. I allowed teachers to describe how cooperative learning, extrinsic rewards, student choice, and goal setting impacted student achievement in mathematics. I also aimed to elicit teachers' perceptions about the effectiveness of incorporating alternative teaching approaches, such as service and adventure learning, into the mathematics classroom and how the alternative strategies affected student self-efficacy. Researchers connected instructional quality to student self-efficacy levels; however, only a few researchers evaluated the concept. I aimed to examine teachers' use of instructional time and perceptions about how to develop instructional quality to enhance self-efficacy for basic skills mathematics students.

Summary

Researchers validated the middle school under study teachers' concerns that struggling middle school mathematics students possessed deficiencies in the areas of problem-solving, computation, number sense, working memory, and self-efficacy. Research studies indicated that struggling mathematics students performed lower on problem-solving tasks than typical-achieving students due to an inability to decipher important mathematical information contained within word problems, communicate mathematical thinking, engage in metacognitive thinking, and navigate multiple-step tasks. Struggling middle school students displayed weaknesses in computation due to early numeracy issues. Researchers found that many at-risk students failed to internalize basic addition, subtraction, and multiplication facts in the primary grades, which affected students' ability to solve more advanced problems in middle school. Researchers also

found that low achieving students struggled with number sense because struggling students lacked an understanding of the magnitude of numbers, especially rational numbers, and failed to develop a conceptual understanding of mathematical processes. The main issues found in the area of working memory of low-achieving students related to the central executive function and visuo-spatial components of working memory mostly; however, the phonological loop played a small role in retaining multiplication facts and recalling information from long-term memory. Low-achieving students displayed weaknesses in both working memory areas, which affected students' ability to retain addition, subtraction, and multiplication facts as well as the ability to store information in the short-term memory while performing other steps in a complex problem. Current research indicated that low-achieving students exhibited less self-efficacy levels than typical-achieving students, which correlated to less effort and more anxiety. Current research indicated that educators incorporate real-life learning, explicit instruction with immediate feedback and frequent practice, computer software, and cooperative learning to improve mathematics performance of struggling students. The teachers in the school under study used explicit instruction extensively and incorporated real-life learning, feedback, practice, and cooperative learning sporadically.

Implications

In this project study, I aimed to analyze the teachers' perceptions about providing educational experiences for basic skills students at the middle school level. The case study design focused on collecting data regarding teachers' perceptions about teaching basic skills students. I used teacher interviews and classroom observations to identify

problematic areas for struggling students, effective instructional strategies for teaching basic skills students, and obstacles teachers encounter when working with basic skills students. The data collected from the case study assisted the researcher in developing a project to improve the instruction for the basic skills students at the school under study. The results and project suggestions might assist teachers in the data-decision making process. Teachers can use the results from the study, in collaboration with formative and summative assessment results, to identify learning deficits and establish smart goals to address the issues surrounding low mathematics achievement for basic skills students.

The school personnel might use collective responses from teacher interviews and results from classroom observational data to engage teachers in professional dialogue and the shared decision-making practices. School personnel might use the case study results to build strong professional learning community discourse about mathematics where teachers can learn best practices from each other and bring about effective change for basic skills students. During professional learning community meetings, teachers might use the data from the study to create Response to Intervention (RtI) level one and level two intervention guidelines for working with basic skills students during regular classroom instructional time and small group intervention time.

Results from the project study might also indicate common gaps in practice among mathematics teachers at the middle school. Results from interview and classroom observational data can assist teachers and administrators in identifying content and instructional knowledge areas of weakness for teachers and students, and the information might help teachers identify annual performance review goals and develop professional

development improvement plans. The information can help teachers and administrators select appropriate professional development activities geared toward helping the school meet state-mandated annual performance and student growth objectives. Implications of using data-driven decision-making, establishing common instructional guidelines, and designing targeted professional development plans are that I will accomplish the overall project study goal of evoking positive change in practice to meet the needs of basic skills mathematics students.

Summary

In summary, basic skills mathematics students at the selected middle school experienced repeated failure on standardized assessments in spite of attending supplementary intervention programs. Basic skills students included those students who fall below the proficient level on standardized assessments. Researchers identified struggling students as falling below the 25th percentile on assessments. Current research indicated that struggling mathematics students display deficiencies in the areas of problem-solving, computation, number sense, working memory, and self-efficacy. I focused on understanding teacher perceptions regarding instruction in the problematic areas for basic skills students. I used teacher interview and observational data collection tools to develop an understanding of how middle school teachers design lessons to teach problem-solving, computational, and number sense concepts currently. I also used the interview questions and observational protocols to elicit information about how teachers develop strategies to address working memory and self-efficacy aspects of learning. I also aimed to uncover teacher concerns in working with basic skills students.

The purpose of the project study was to identify problematic issues for basic skills students in an effort to improve mathematics performance and evoke social change for this population of students.

Section 2 presents the methodological design for the project study. An analysis of the methodology provides the decision-making process behind selecting a qualitative case study design. Section 2 also presents the participants, setting, and data collection tools and process for the project study, as well as the selection process. Section 3 provides an explanation of the project and proposed suggestions for addressing the problem. Section 4 summarizes my reflections regarding the project study process.

Section 2: The Methodology

Introduction

In this project study, I aimed to address the problem related to underachievement in mathematics for basic skills students at the middle school level. A portion of the basic skills mathematics student population at the middle school studied continues to fall below the proficient level on the NJ ASK and needs supplemental support. The state of New Jersey requires schools to maintain adequate yearly progress toward closing achievement gaps and achieving student growth objectives (NJDOE, 2013b). Under the new teacher evaluation system, student growth averages will partially determine teacher effectiveness (NJDOE, 2013a). Students will need to pass state assessments to graduate; all of these factors create a pressing need for basic skills students to reach the proficient level on the state assessment.

To improve student performance, educators need to understand the everyday experiences of basic skills students. Teachers possess a wealth of knowledge about the functioning of basic skills students since they interact with students daily. The qualitative project study was focused on eliciting key teacher testimonies and observing significant teacher behaviors to understand the complex phenomenon of teaching basic skills students. I used interview and observational data collection instruments to answer the following research questions:

1. What are sixth grade teachers' perceptions of the student self-efficacy factors that affect mathematics instruction for basic skills students?

2. What are sixth grade teachers' perceptions of the working memory of basic skills students?
3. What are sixth grade teachers' perceptions of problem-solving instruction for basic skills students?
4. What are sixth grade teachers' perceptions of computational instruction for basic skills students?
5. What are sixth grade teachers' perceptions of number sense instruction for basic skills students?
6. What are sixth grade teachers' perceptions of the challenges teachers face when providing instruction for basic skills students?

The purpose of the study was to learn more about instruction of sixth grade basic skills mathematics students and deficits they experience while interacting with mathematics concepts. The following section provides an outline and justification for the qualitative study design and provides an explanation of how the project design addresses the research questions.

Research Design and Approach

The study was qualitative as the research questions were designed to investigate teachers' perceptions about mathematics instruction of basic skills students. I analyzed current literature and found numerous quantitative studies that identified the predictive factors of mathematics performance and evaluated the effectiveness of mathematical interventions. I found very few studies that related to understanding teachers' perceptions about issues contributing to low achievement. Educators need qualitative

research to develop an understanding of the realities of mathematics instruction for basic skills students.

Perceptions relate to a person's thoughts, feelings, and motives, which researchers capture through qualitative designs (Stake, 1995). Because teachers have indicated that basic skills students lack motivation, working memory, engagement, computational, number sense, and problems-solving skills (mathematics teacher, personal communications, September 5, 2012), I focused on investigating teachers' perceptions about how to address the needs of basic skills students. I aimed to understand the alignment of current mathematics practices with research-based best practices in an effort to fill gaps in practice. The research questions were designed to help me determine patterns and relationships instead of cause and effect connections, which aligns with qualitative research (Stake, 1995). The study was not designed to control the behavior of participants but was designed to understand select teachers' perspectives regarding the phenomenon of mathematics performance; therefore, a quantitative experiment did not match the purposes of the study (Yin, 2014). I proposed suggestions to teachers and administrators about gaps that exist to improve the mathematics program at the school under study. The qualitative design helped me collect information about the current mathematical practices of teachers at the middle school, which led to interpretations about the natural experiences of mathematical teachers and basic skills students (Stake, 1995).

Lin (2014) explained that researchers should make decisions about research design based on the type of research questions created for the study. The research

questions for the project study were designed to help me understand how teachers described the mathematical instruction of basic skills students. Lin described questions that answer “how” as explanatory in nature and suggested that researchers investigate the answers to “how” questions through case study design; therefore, I used the case study design. I studied sixth grade mathematics teachers to understand the everyday experiences of teaching mathematics concepts to struggling students. Stake (1995) identified a distinguishing characteristic of case study research as seeking particularization. The case study data were interpreted, and analytic generalizations were made to determine how the lessons learned from the teachers’ accounts aligned with the experiential, social development, and motivational learning theories outlined in the literature review.

Stake (1995) identified two characteristics of a case study design as boundary and time limits. The project study participants were a bounded unit consisting of middle school mathematics teachers at the focus school (Merriam, 2009). The focus of the project study was to get an in-depth understanding of mathematics instruction at one school, as opposed to understanding mathematics instruction across several schools; therefore, a case study approach was more appropriate than a grounded theory approach (Merriam, 2009). All mathematics teachers at the middle school worked with basic skills mathematics students, so multiple cases within the middle school were studied. I collected data over the course of one month to provide adequate time for collecting in-depth information.

Participants

Yin (2014) advised researchers to select participants in a case study design carefully based on the factors of accessibility and relevancy. Participants should provide rich information about the phenomenon under investigation (Yin, 2014). Creswell (2007) recommended selecting four to five participants in a single case study because the researcher can analyze this number of participants and still find themes and collect in-depth data for each participant. Yin suggested that the more cases a researcher analyzes the more compelling the results, while Stake (1995) stated that using several participants in a case study design provides a strong representation of the multiple realities of the phenomenon. Based on these suggestions, I intended to include four to six teachers who agreed to participate in the study to represent the case. Stake further explained that the case study design does not use purposeful sampling techniques because the case does not come from a larger population, but instead describes the participants as critical, unusual, common, revelatory, or longitudinal cases based on the purpose of selection. The project study design included common cases to understand the everyday experiences of teachers in working with basic skills mathematics teachers. The project study setting fit the common case criteria because I studied multiple participants who worked in the typical classroom setting. The suburban middle school under study housed approximately 650 students. The school was structured like a typical middle school design with six teams of students who rotated to four content area teachers during the course of a day. The school personnel followed the ability-grouping philosophy by dividing the students into mathematics classes based on performance on standardized assessments. The school

leadership first divided the students into six teams by balancing academic levels and special education students among the teams. The leadership then created the mathematics classes within the teams by placing top-performing students in the advanced mathematics course, average-performing students in the regular mathematics course, and the low-performing students in the slower moving regular mathematics course.

The state of New Jersey identified the particular middle school selected for the study as a focus school in need of improvement. The school contained a portion of sixth grade basic skills mathematics students who demonstrated a history of repeated failure on the state assessment in spite of receiving interventions. There were 14 mathematics teachers, and only six of these teachers instructed students in the regular classroom environment. The remaining eight teachers were special education and basic skills mathematics teachers who did work with students in the regular classroom environment at times but primarily interacted with students in pullout atmospheres. In this project study, I aimed to uncover the regular education instructional practices of basic skills students; therefore, I intended to use the six regular education teachers to make up the case because they possessed the richest information about teaching basic skills students daily. Five teachers from the middle school agreed to participate in the study. The teachers varied in years of experience, ranging from 5 to 16, in number of basic skills students, and in number and types of degrees held by teachers (see Table 2). All of the participants were female and held a highly qualified status in mathematics. Because five classroom teachers agreed to participate in the study, the study had an appropriate amount of cases as specified by Creswell (2007). If, however, less than four teachers had agreed

to participate, I would have invited the two basic skills teachers to participate in the study, which would have ensured that the study included an appropriate amount of cases to get a strong representation of the reality of instruction of basic skills students. I decided to include the basic skills teachers as an alternative option because the basic skills teachers did have some experience in working with the basic skills students in the classroom setting.

Table 2

Demographic Data About Teachers

Demographic	Results
Total years of experience	Ranges from 5-15 years
Years of experience in middle school	Ranges from 4-6 years
Number of basic skills students	Ranges from 2-11 students
Number of Master degrees	3 Master's degrees among 5 teachers
Number of degrees in mathematics	0
Number of certifications	11 certifications among 5 teachers
Types of certifications	Supervisor Middle school mathematics Teacher of the handicapped Middle school language arts Middle school science

Lodico, Spaulding, and Voegtle (2010) suggested that researchers manage entry into the research site carefully to ensure a strong working relationship. Researchers establish strong working relationships through communication, sensitivity, and honesty (Lodico et al., 2010). I worked at the middle school previously and had already

established a strong working relationship with the participants. I gained familiarity with the principal and mathematics teachers through interactions during professional learning community endeavors; therefore, a collegial relationship of trust and respect existed between the participants and myself. I never held a supervisory role related to any teacher at this school; thus, the teachers and I possessed equal status. The personnel at the research site should have felt comfortable in inviting me into the site.

To ensure adequate access to the site, I followed the appropriate district procedures and IRB process for obtaining permission to conduct research. I arranged a meeting with the principal to introduce the study and gained permission to use the middle school as the research site. An official request letter was sent to the Board of Education to request district approval to conduct the study through e-mail. After district approval, I submitted the research proposal and letter of district cooperation to the Walden IRB committee to obtain approval for the study (see Appendix A). After IRB approval (04-23-14-0052359), the IRB approval paperwork, as well as the NIH certificate, was shared with the school district, a participant invitation was sent to the potential participants through e-mail (see Appendix B), and a meeting with the classroom mathematics teachers was arranged to share information regarding the purpose, procedures, and requirements of the study in an attempt to gain access at the classroom level.

Yin (2014) stressed the idea that researchers need to obtain the highest ethical standards for “responsibility to scholarship” (p. 76). I included measures to protect the rights of participants and to ensure responsible scholarship. I obtained informed consent from each participant by having the participants sign the informed consent (see Appendix

C) and audiotape release form (see Appendix D). Potential participants attended an informational session at the beginning of a department meeting to learn about the purpose, research questions, and procedures for the study. The informational session helped participants know what to expect prior to the study (Creswell, 2012). At this meeting, participants received information about the rights of participants and the volunteer nature of participation. I handed out the consent forms at the informational meeting and gave teachers one week to make a decision about participation. Teachers returned consent forms directly to me in a sealed envelope. I set up initial interview and observation times after teachers handed in consent forms. Teachers arranged the closing interview times after completion of the last observation.

Lodico et al. (2010) described qualitative designs as unpredictable because research questions and purpose often emerge in response to data collection. To maintain credibility of the informed consent process, I communicated any changes in the nature of the study to participants regularly. I protected participants from harm by avoiding deception and allowing participants to withdraw from the study at any time. The use of pseudonyms protected the participants' privacy and confidentiality. The steps to obtain informed consent and protect participants helped me to build trust and establish rigor.

Data Collection

Stake (1995) explained that qualitative data collection processes take time and involve unanticipated issues; therefore, Stake suggested that researchers create a documented plan. Stake also advised that the plan derive from designing tasks that elicit information related to the research questions. Qualitative methodologists promote the

idea of incorporating multiple types of data collection as part of the systematic plan to ensure credibility (Creswell, 2012; Merriam, 2009; Stake, 1995; Yin, 2014). Based on these suggestions, I created a systematic data collection plan. The project study research questions aligned with current literature theories about why students struggle in mathematics. The data collection process included interview and observation techniques to elicit information about teachers' experiences with instructing basic skills students to uncover how the theories applied to the context of the study. The observational technique helped me to collect information about the actual behaviors of the teachers in the natural setting of the mathematics classroom. Observational processes also helped to gather data from teachers who may have had difficulty describing their practice (Creswell, 2012). One-on-one interview data provided me with information to help uncover the reasons behind the teachers' instructional decision-making process when working with basic skills students (Creswell, 2012).

Other data-collection techniques may have had merit in qualitative research but were not beneficial for this particular project study. Researchers use focus interviews obtain information from individual participants but also collect data to depict the group's shared understanding of a phenomenon (Creswell, 2012). The purpose of the study was to understand each participant's personal views on teaching basic skills students. One-on-one interview design helped me to spend extensive time with each participant to develop a deeper understanding about his/her thought process when instructing basic skills students (Creswell, 2012). I used one-on-one interviews to determine what strategies teachers implemented when working with basic skills students.

Researchers use document analysis techniques to use public records to verify teaching practices (Creswell, 2012). In this case study, lesson plan analysis would have helped me understand teacher practices with basic skills students; however, based on my experience from working in the district, the sixth grade teachers do not use a consistent way of writing lesson plans. Many teachers write general sketches, which do not document instructional strategies used for basic skills students. The data analysis of the lesson plan documentation would not have revealed sufficient data to answer the research questions. The data collection methods of interviews and observations best fit the research purpose and questions and helped me to triangulate data to arrive at a deep understanding of basic skills instruction. Table 3 reveals the connection between the data collection methods and the research questions.

Table 3

Research Questions and Data Collection Correlation

Research question	Interview question	Observation domain
Questions 1: What are sixth grade teachers' perceptions of the self-efficacy factors that affect mathematics instruction for basic skills students?	Questions 8, 10, 11, and 12 (Initial interview)	Domain and component: 2a, 2b, 2c, and 2d
Question 2: What are sixth grade teachers' perceptions of the working memory of basic skills students?	Questions 9, 10, 11, and 12 (Initial interview)	Domain and component: 2e, 3a, 3b, 3c, 3d, and 3e
Question 3: What are sixth grade teachers' perceptions of problem-solving instruction for basic skills students?	Questions 5, 10, 11, and 12 (Initial interview)	Domain and component: 2e, 3a, 3b, 3c, 3d, and 3e
Question 4: What are sixth grade teachers' perceptions of computational instruction for basic skills students?	Questions 6, 10, 11, and 12 (Initial interview)	Domain and component: 2e, 3a, 3b, 3c, 3d, and 3e
Question 5: What are sixth grade teachers' perceptions of number sense instruction for basic skills students?	Questions 7, 10, 11, and 12 (Initial interview)	Domain and component: 2e, 3a, 3b, 3c, 3d, and 3e
Question 6: What are sixth grade teachers' perceptions of the challenges teachers face when providing instruction for basic skills students?	Questions 1, 2, 3, and 4 (Closing interview) Questions 1, 2, 3, 4, and 12 (Initial interview)	Domain and component: 2a, 2b, 2c, 2d, 2e, 3a, 3b, 3c, 3d, and 3e

Data Collection Processes

Creswell (2012) described the qualitative data collection process as extensive and time consuming due to the fact that the researcher seeks to understand the complexity of the central phenomenon. I anticipated conducting an initial 45-minute interview with each participant. The initial interviews lasted between 35-40 minutes for each participant. I also anticipated conducting three observational sessions for each teacher. The observational sessions were intended to last for 50 minutes or until the class period ended. I conducted the planned observations, which lasted for 55 minutes. The observations occurred over a three-week period to ensure that I obtained an accurate view of teachers' experiences in working with basic skills students (Creswell, 2012). A closing interview, which was intended to last approximately 30 minutes, was conducted with each participant to provide valuable insights into the reasons behind the teaching practices noted during observations. The closing interviews lasted approximately 15 minutes. I followed planned procedure for collecting and recording interview and observational data.

Interviews. In this project study, I incorporated an interview process to learn about instruction of basic skills students from the gatekeepers who possess this knowledge, teachers. Creswell (2012) suggested that the interviewing process consist of posing broad open-ended questions, which allow the participant to share his or her experiences without feeling constrained by specific questions. The use of open-ended questions may cause issues for the researcher when forming themes because the participants' responses may not relate directly to the context (Creswell, 2012); therefore,

I used semistructured interview questions to create a common thread in each interview while also maintaining an open forum where the teachers experienced freedom to tell his or her story. The semistructured questions emerged from the literature review and research questions and related to the topics of problem-solving, computation, number sense, working memory, and self-efficacy. The interview questions also were designed to elicit information about research-based best practices and teacher-identified problematic areas. I created probes, or subquestions, to encourage the participants to give detailed responses such as “could you explain what you mean by.” (Creswell, 2012). I used two external auditors to evaluate the interview protocols for credibility. One external auditor suggested that I add a question to determine how many basic skills students each participant currently taught to give background on the extent of experience teachers possessed in working with basic skills students. The second external auditor thought it would be helpful to include a definition for working memory on the interview protocol since the interview protocol already included a definition for number sense. Based on these suggestions I made the following additions:

1. How many basic skills students do you currently instruct?
2. Describe your experiences with working memory, which is the cognitive system responsible for sorting, processing, and storing information, of basic skills mathematics students.

I created interview protocols for the initial and closing interviews to help document and organize the information collected during the interview process (Creswell, 2012). The protocol headers for the initial interview protocol (see Appendix E) and

closing interview protocol (see Appendix F) contained spaces to record information about the participants and details about the interview. The protocol also included information about the purpose of the study, which was read to the participants at the beginning of the interview as suggested by Creswell (2012). The information collected on the interview protocol did not violate the participants' confidentiality. I assigned each participant a linking number in order to track participant's data in the event that a participant opted to withdraw from the study; however, none of the teachers opted to withdraw. The linking data helped me to eliminate the data for the teacher who withdrew from the study. The majority of the interview protocol included the semistructured questions and spaces for me to take brief notes from the participants' responses.

I greeted the participants and reminded the teachers of the participants' rights at the beginning of each interview. I asked the participants if they had anything additional to share, then thanked them for their time at the end of each interview. I took notes to record main ideas during the participants' responses to the questions. I also used a digital recorder to audiotape the interview and transcribed each interview immediately to ensure that research notes presented accurate accounts of the teachers' classroom experiences (Creswell, 2012). After each interview, I created a transcript of the interview using a word processing program and saved the transcript as the method for organizing and storing the data. I gave a copy of the interview transcript to each participant as part of the member check process. The participants were instructed to approve or reject the transcript and clarify misunderstandings. All participants approved the transcripts, and only one participant made a change. The participant added more detail to two responses.

Observations. The project study design also included an observational process to analyze teacher behaviors in the natural setting of the classroom. Creswell (2012) stated that observations provide researchers with a chance to collect data as the experience happens, which makes the information reliable. The observational process of the project study provided information that helped me to compare what teachers said happened in the classroom to what actually occurred when teaching basic skills students. I took the role of nonparticipant observer to avoid altering the participants' behaviors as much as possible and to help teachers feel comfortable in the observational process (Creswell, 2012).

I used a standardized observational protocol during data collection to help document the reality of instruction in the classroom. By using a standardized form, I was able to maintain consistency when evaluating teacher performance, which increased the reliability of the results (Lodico et al., 2010). I used the observational protocol to collect data that revealed what instructional strategies teachers actually implemented in the areas of problem-solving, computation, number sense, working memory, and self-efficacy when teaching basic skills mathematics students. The protocol included space to record information about the details of the observation, setting, lesson, and copyright policy (see Appendix G). The protocol did not contain information that violated the participants' confidentiality. I assigned each participant a linking number in order to track participant's data in the event that a participant opted to withdraw from the study. The linking data helped me to eliminate the data from the teacher who withdrew from the study; however, none of the teachers opted to withdraw from the study.

I used the 2013 version of The Framework for Teaching Evaluation Instrument (see Appendix G) as the observational tool for the study (Danielson, 2013). Danielson (2013) created a generic teacher evaluation tool that evaluators could apply to any discipline. Danielson's Framework for Teaching Evaluation Instrument measures teaching attributes identified as effective in current literature (Danielson, 2013). Danielson organized the framework into four domains that together measure 22 components of effective teaching. The designers of the instrument created a comprehensive instrument and did not intend for observers to use the instrument in its entirety for each observation. Instead, the designers intended for researchers to select aspects of the instrument that match the observer's purposes. I, therefore, used Domain Two: The Classroom Environment and Domain Three: Instruction, because domain two and three related to the project study topic of identifying effective instructional strategies for teaching mathematical concepts and developing a positive culture for learning. Domain One: Planning and Preparation, and Domain Four: Professional Responsibilities, measure teacher behaviors outside the classroom, which was not a focus of the study. The copyright information provided by the author permitted me to use the instrument at the middle school site without seeking written permission (see Appendix G). The publisher permits the downloading and use of a single PDF version of the instrument; however, the copyright policy prohibits the reproduction of the downloaded version. The publisher requires users who need multiple copies to purchase a copy of the bound book containing the instrument; therefore, I downloaded one version of the

evaluation and purchased additional books from Amazon to obtain the remaining copies of the evaluation instruments.

I selected Danielson's Framework for Teaching Evaluation Instrument because the evaluation instrument measures attributes that align with teaching the CCSS, which influence classroom curriculum and instruction. Many school district personnel opted to use Danielson's Framework for Teaching Evaluation Instrument to meet the requirements of the new teacher evaluation systems. The middle school in the study used Danielson's Framework for Teaching Evaluation. The participants and administrators were familiar with the language and attributes on the evaluation tool, which might have made the results of the study easier to understand.

The domains within Danielson's instrument contain components that outline effective teaching (Danielson, 2013). Each component includes sets of smaller attributes that define each component by identifying effective teacher and student behaviors within the domain (Danielson, 2013). Domain 2 lists five components related to effective teacher traits for establishing an environment conducive to learning. During observations, I focused on recording data related to the critical attributes of respect and rapport, a positive culture, managing procedures and behavior, and organizing physical space listed within Domain 2 because the attributes correlated with the literature review findings that student behavior, classroom climate, high expectations, and technology usage influenced student self-efficacy and improved mathematics performance. Domain 3 lists five components outlining effective instruction. While conducting observations, I focused on collecting data regarding the critical attributes connected to the components of

communicating with students, questioning and discussion techniques, student engagement, assessment, and teacher responsiveness because the identified instructional components also related to the findings in the literature review. I specifically focused on the teacher's use of teacher modeling, student justification, higher-level questioning, multiple solutions, student reflection, teacher feedback, differentiated instruction, and diverse teaching strategies since researchers identified the attributes as effective strategies for improving the problem-solving, computational, number sense, and working memory skills of basic skills students. The open-ended wording of the components and attributes on Danielson's instrument provided me with flexibility in identifying the various strategies the mathematics teachers employed during instruction with basic skills students, which I then compared to the effective mathematics instruction findings outlined in the current literature.

During each observation, I took notes on identified behaviors related to Danielson's Framework for Teaching Evaluation Instrument attributes in the blank spaces under each domain (see Appendix G). I recorded information specifically related to teachers' use of the attributes during instruction of basic skills students. I recorded information to identify what strategies mathematics teachers used within the component, how the basic skills students responded, important dialogue that occurred between the teachers and students, and evidence indicating the success of the strategies. The identified components and observational notes helped me to record only information that answered the research questions. After each observation, I determined a rubric score for the components under each domain and recorded the rubric scores directly on the

evaluation instrument. The rubric scores were not discussed in the analysis process of the report but were only used as a guide for terminology references when drawing conclusions about the data. I made the decision to not use the rubric scores in the report as a means to protect the participants from negative consequences that might occur as a result of low rubric score results. I read the data and coded it immediately after the observations to make sure analysis was completed while the information was fresh in my mind. I saved the instrument containing the notes and stored the written field notes in a locked file box to keep the data organized for the required five years after the study.

Researcher's Role

I performed several roles throughout the project study. During the data collection process, I acted as an interviewer, observer, data recorder, and interpreter. Through the case study design I gained an accurate understanding of a central phenomenon by engaging in the real-world settings of participants (Lodico et al., 2010). I needed to avoid disturbing the natural classroom setting to ensure authenticity of the data (Lodico et al., 2010). I avoided altering the setting by taking on the role of nonparticipant observer where I visited the classroom and recorded field notes without becoming involved with the students or the teacher directly (Creswell, 2012).

I also held the role of teacher at the school site, which influenced the study on a limited level. Although I worked as a sixth grade teacher at the middle school, I obtained a one-year leave of absence to complete my doctorate study and did not interact with the participants. I returned to the mathematics position at the school under study for the 2014-2015 school year, which could have caused coercion because they might have felt

compelled as my co-worker to agree to participate. I reduced the feeling of coercion by reassuring the participants that our professional and personal relationship would not be affected if the participants opted out of the study. I also reduced coercion by allowing the participants to communicate about the decision to participate through e-mail to create a non-pressure atmosphere. I also held no supervisory role over the participants, which reduced any feeling of coercion for the participants. My past relationship with the participants helped me avoid being seen as an outsider and gain access and trust with the participants. Having taught at the middle school for five years, I acquired experience in working with basic skills students. The experience could have created biases as I may have brought preconceived notions about instruction for struggling mathematics students into the project study process. I tabled bias by asking research experts to review research questions, data collection tools, data analysis interpretations, and results for evidence of bias. I elicited feedback from two external auditors and modified project study elements to avoid bias based on the feedback.

Data Analysis

Stake (1995) described analysis as a process of giving meaning to first impressions. Stake suggested that researchers analyze data by breaking down impressions and building relationships between the chunks of data. Relationship building occurs through interpretation and aggregation. Creswell (2012) agreed with the idea of breaking data into chunks but believed that researchers should develop an overall sense of data first. Researchers build relationships within data by looking for patterns and consistency across data (Stake, 1995). The process of data collection yields extensive

data, so the researcher should “identify the best and set the rest aside” (Stake, 1995, p. 84). Based on recommendations from the methodologists, I determined what to analyze and what to set aside based on the research questions and central phenomenon. The data analysis process, for the project study, involved coding interview transcripts and observational instrument data to reveal commonalities and themes about instruction for basic skills mathematics students.

Creswell (2012) suggested an iterative six-step process to code data. The project study based data collection on the six-step process. I collected data from interviews and observations and transported interview information to a word document. I read through the documents thoroughly to develop a general sense of the data immediately after interviews and observations ended. During the first reading, I created memos in the margins of the document to note first impressions and hunches about instruction for basic skills students (Creswell, 2012). During the memo step in the process, I also read the data over and over to develop a strong understanding about the detail found in the data (Creswell, 2012). I coded data by dividing the text from the interview and observational protocols into segments and labeling the texts with codes. I examined the codes for commonalities and collapsed the codes into three themes that I used to create descriptions for the written report when answering the research questions (Creswell, 2012). Based on the vast amount of mathematics topics included in the research study and interview questions, I found that teachers gave both complex and wide-spread responses. I, therefore, picked broad themes to incorporate the various ideas about instruction of basic

skills students. The themes that emerged from the interview data were extent of the problem, problematic areas, and instructional strategies.

I analyzed the data continuously and simultaneously by completing the six-step process immediately after collecting and transcribing each data piece. I color-coded the first set of interview notes to create codes that related to the predetermined topics of problem-solving, computation, number sense, working memory, and self-efficacy and considered additional topics that emerged during data collection. As I conducted subsequent interviews, I compared codes to previously analyzed interview data to consolidate codes until I completed the interview process. I then used the blended codes from the six interviews to create three themes that reflected the teachers' perceptions about successful instructional strategies and obstacles for basic skills students. I completed the same process with the 18 observation and six closing interview data documents. I used Danielson's observation rubric terminology and field note descriptors to help identify codes and themes. I completed the data analysis process by comparing codes and themes from the interview and observational data to develop relationships between the two sets of data. When comparing the two sets of data, I was able to confirm the themes: extent of the problem, problematic areas, and instructional strategies.

Interview Findings

In the interview process, I learned about each teacher's perspective regarding the mathematics instruction of basic skills students. Each teacher described their experiences in working with basic skills students in the areas of self-efficacy, working memory, problem-solving, computation, and number sense. In developing the findings, I read and

reread the transcripts to discover common themes. I first discovered themes across the topics of problem-solving, computation, self-efficacy, working memory, and number sense. I noticed that the teachers discussed problematic areas, instructional strategies, successes, and struggles in each of the topic areas; therefore, I identified the themes as extent of the problem, problematic areas, and instructional strategies. Due to the complexity of the teacher responses, I also found subthemes within each topic area, which is discussed under each research question. I was able to confirm data analysis themes that emerged from the common interview responses by noting common behaviors. The color-coded responses and circled codes evident on the interview transcript and observational records helped me to identify the themes of extent of the problem, problematic areas, and instructional strategies.

Research question 1. Responses to the interview questions related to self-efficacy indicated that teachers agreed that some basic skills students struggle with self-efficacy, which ultimately affects mathematics performance. The interview data indicated that teachers do not see universal self-efficacy issues across the basic skills population, but do see the issue in many basic skills students. One teacher commented that when comparing the two basic skills students in her class, she believes “the two students are at complete ends of the spectrum.” One of her students demonstrated strong self-efficacy while the other lacked confidence. Another teacher described the situation as, “I would say that out of the entire list I have, there is one student that I could say seems to possess confidence in her abilities.” A third teacher explained that, “I don’t know that I have seen an overlying across the board lack of motivation.” She described

the current basic skills students as motivated to do well but did express that the students were frustrated when they struggled to grasp mathematical concepts.

The interview sessions also provided information about problematic areas related to self-efficacy issues. The themes that developed under problematic areas were self-efficacy characteristics and performance pressure. In the responses, teachers described the differences between the basic skills students who displayed higher self-efficacy levels and the basic skills students who displayed lower self-efficacy levels. One teacher described her strong self-efficacy students as, “for the most part, do, I guess they advocate for themselves, and they do ask questions, and they are motivated to get it right because they want to be better at it.” Another teacher described the behaviors of the students who display low self-efficacy. The teacher stated that students demonstrated:

No participation, you can see them just sitting there. They may have their pencil in their hand, but they are really not doing any work. Or if they are working in a group, you can see that the child is really taking the back seat and letting everyone else do the work.

Table 4 contains a list of characteristics that the teachers identified with students who demonstrated positive self-efficacy and with students who demonstrated low self-efficacy.

Table 4

Attributes Associated With High and Low Self-efficacy Levels Identified by Teachers

Attributes	Number of teachers who indicated the attribute
Attributes associated with high self-efficacy	
More confident	1
Frequent participation	1
Outgoing personality	1
Classwork completion	1
Homework completion	2
Work meets expectations	1
Effort	1
Takes pride in work	1
Strong study skills	2
Ask questions	1
Motivated	1
Attributes associated with low self –efficacy	
Disappointment	1
Shy	1
Poor attendance	1
Inconsistent homework	2
Irresponsible with materials	1
No participation	1
Lack of motivation	1
Inconsistent performance	1
No parent support	1
Lack of work ethic	1

Another problematic area noted by teachers in the interview sessions was related to performance pressure. Over half of the teachers expressed that student focus on grades and comparison to other classmates affects self-efficacy levels. The first teacher explained that the make-up of the class contributed to the self-efficacy levels of the students. The teacher commented that the class make-up consisted of struggling learners.

The teacher described the students in the class as special education students, basic skills students, or struggling learners. The teacher felt that the make-up impacted self-efficacy in a positive way. The teacher stated, “I actually think to some degree they don’t realize maybe how lacking their math skills are when comparing themselves to their peers.” The teacher believed that when the students compared themselves to other students in the class “they feel as though they fit in with that class.” Another teacher described how basic skills students often compared themselves to other students and in some cases siblings. The teacher described how one basic skills student in the class compared her scores to a general education student and when the student scored higher than the general education student, the student felt more confidence. The teacher explained that achieving higher scores than general education students “helps boost her [the student] morale and positivity on some of the things that she is doing.”

A third teacher, however, noticed that focus on grades negatively impacted self-efficacy levels. The teacher noted that, “They, not just basic skills students, in general, are very focused on grades rather than on actually learning, which affects their confidence.” The teacher explained that students express dissatisfaction with a grade below an 80% and view the grade as failing. The teacher explained that the view impacts self-efficacy because “they think of it as failing and really they’ve gone from knowing nothing to knowing a good amount of information in order to get something in the 70s and especially to get something in the 80s.”

The interview data indicated insights about teachers’ instructional strategy decision-making process. Interview data under instructional strategies provided

information about the subthemes positivity, teacher feedback, high expectations, and cooperative learning. Interview data indicated that most of the teachers shared the instructional strategy of positivity when addressing student self-efficacy levels. Teachers expressed that they make an effort to identify the times when the basic students excel and praise the students. The first teacher commented that,

I also put comments in the parent portal if I notice that the student has had a good day and has been consistently prepared or doing their work or asking questions . . . so that when the student goes home their parent says I am proud of you.

Another teacher explained that she provides positive reinforcement for basic skills students by “the high five’s around the classroom, the positive reinforcement, you know the encouragement.” The same teacher also provides positive reinforcement by calling on basic skills students in safe situations with simple answers so the students “positively, absolutely, without a doubt answer that question, and they are participating in class, and there is no repercussion from or chance that they can get it wrong.”

Other teachers identified using feedback as an instructional strategy to improve self-efficacy levels of basic skills students. The teachers described giving feedback in private ways in an effort to keep student’s information private. The first teacher explained, “I always try to be positive and say now let’s talk about this, let’s see what you didn’t understand and definitely go over the mistakes with them so they hopefully can learn and see what their misunderstanding was.” Another teacher stated that,

I will find time to talk to them one-on-one to help them see that yes I recognize the progress that they are making and point out what teachers' definitions of progress are versus what the students' definition of achievement is.

A final teacher described how she gives feedback to students who display a reluctance to ask questions in class. The teacher explained that she provides a place for students to place questions written on index cards so that students do not have to ask the question in front of the class. The teacher explained that if she gets a question card,

I find a way to get back to them whether it is at the beginning of class or talking to them, or writing the answer on the index card, or finding them in the hallway during dismissal and quickly touching base with them.

One teacher mentioned the importance of setting high expectations as a way to build self-efficacy. The teacher explained differences between the work ethic of basic skills students placed in the lowest-level class with all struggling learners and the basic skills students placed in the seconded-lowest class that contained fewer struggling learners and more on-grade level students. The teacher stated, "I found that it was easier for them to kind of you know, they couldn't just get by with the minimal [amount of effort]. They kind of had to work a little bit hard to rise to the level of the other kids in the class."

Two teachers discussed the significance of using cooperative learning to build self-efficacy levels of basic skills students. One teacher explained that in a class of mixed abilities, cooperative learning is beneficial. The teacher stated,

Sometimes it would be nice because students sometimes are more comfortable with their peers than a teacher. So, it would be a situation where you could assign a buddy like ok why don't we work together and see if you could maybe do a little bit of peer tutoring. And sometimes the students respond better to that than feeling like they are the one who doesn't get it and having the teacher have to meet with them.

The teacher expressed that in a class of struggling learners it might be difficult to use peer tutoring because struggling learners have deficits in many mathematical areas.

The other teacher explained that assigning students roles during cooperative learning is beneficial in developing self-efficacy. The teacher discussed that giving students roles based on strengths helps them to be successful during mathematics tasks. The teacher commented, "Sometimes basic skills students will be strong in a certain area whether they are good at organizing something or they're a good note taker, giving them something they can be successful with."

Some teachers also discussed a negative factor that affects self-efficacy levels of basic students. The teachers discussed how designing mathematics classes based on a leveling philosophy creates obstacles for teachers and students. One teacher stated that she struggles to implement exploration-based learning. The teacher understood the importance of using the strategy with the students to improve motivation and learning but stated that,

So while I am trying to move towards you know more exploration in my classroom rather than direct instruction, when it comes to basic skills students, I feel like I don't want them to kind of sit there in you know, I guess just confusion while everybody else is having a mathematical conversation, and I am not sure how much they can add to the conversation.

The teacher explained that students have limited experience with exploration learning, so she has to pull and prod to get students to make connections, which takes extensive amounts of time.

Most of the teachers' responses to the interview questions about self-efficacy aligned with the findings described in the literature review. The teachers agreed that basic skills students may display less confidence and demonstrate less effort, which affects mathematics performance. The teachers also supported the view that positive reinforcement and corrective feedback, setting high expectations, and using cooperative learning improved self-efficacy levels; however, the teachers discussed the struggles of implementing cooperative learning and alternative teaching models in a leveled-class made up of all struggling learners.

Research question 2. Responses to interview questions related to working memory indicated that teachers agreed that basic skills students struggle with memory issues, which ultimately affects mathematics performance. The teachers, however, attributed the issues to different aspects of memory. Some teachers connected issues to working memory while one teacher related issues to short-term memory deficits instead.

One teacher responded that, “In my experiences, their working memory is not as, not sure what word I am looking for, but not as successful as other students in that they have a hard time retrieving information.” Another teacher explained, “Well, I think the reason that they are in basic skills is often that that [working memory] becomes difficult for them.” A third teacher stated that, “Well, I would say that retention is a tremendous problem.” While a fourth teacher noted, “I think they struggle with their working memory. I have seen some of these students understand concepts on a daily basis, but then the next day forget what we did the previous day.” The last teacher saw the issue differently and stated that,

They tend to have a good working memory because if you go over or do a problem with them, they can work back through it. I think getting it from working memory into not even necessarily their long-term but their short-term memory just to be able to pull back, pull from it the next day.

During the interviews, teachers also described how working memory issues affect mathematical learning. The teachers noted several problematic areas for students, which emerged into the subthemes of application and procedural processes. Two of the teachers explained that working memory issues create application problems for basic skills students. The first teacher commented, “As I stated earlier, if information is presented in a different manner, they have a hard time applying what they have already learned to that new situation.” The second teacher stated that, “So, I think if we vary our problem-solving questions, students won’t fall victim to the automatically doing what they think they need to do.” These two teachers described how students with weak working

memory issues experienced difficulty in sorting through new information to make connections to previous learning.

Other teachers noted issues related to procedural processes. One teacher described that students struggle to apply the correct mathematical terms while completing procedures. The teacher stated, “Sometimes words will come out, and they do understand what they are talking about, but they almost can’t form it into a sentence that makes mathematical sense.” Another teacher described how working memory issues affect students’ ability to follow the steps to solve word problems because the students experience sorting deficits. The teacher explained, “You know just sorting out what material is the most important. For instance, in word problems sometimes you are given additional information that you may not need...and sometimes they will use it all.” The final teacher connected working memory issues to being able to follow mathematical formulas. The teacher explained that basic skills students apply the formula in a rote fashion without thinking the problem through. The teacher stated, “We have modeled that type of question [area] starting with the formula, plugging in the values for the variables that we have...and my basic skills students will multiply the area times the width to get the length.”

In the interview sessions, the teachers identified instructional strategies that they use to help students overcome working memory issues, which emerged into the subthemes of note-taking, guided practice, multiple modalities, reflection, and prior knowledge. Three teachers described the importance of establishing note-taking routines

with students in an effort to provide students with examples to refer back to when students experience an issue with retention. The first teacher explained that,

To help their working memory, we always refer back to examples in our notebooks or notes that we have so they can see a visual representation of what they did and kind of be almost forced to remember that you did actually do this.

The second teacher noted, “That is one of the reasons I started using my interactive notebook this year, not that it necessarily improves their short-term memory, but it gives them something to refer back to.” The third teacher explained that she tries to encourage use of notes by requiring them to use the notes at home during homework. The three teachers described how notes are used to help students overcome memory deficits.

Other teachers believed that guided practice helps students with working memory issues. One teacher described the significance of providing guided practice during spiraled instruction. The teacher believed that students need constant exposure to different mathematical concepts taught during the year. Another teacher described how using guided practice helps students overcome the issue of not knowing how to approach a problem. The teacher explained that, “I will scaffold the problem by starting the problem, and then have them maybe finish it up so at least I can maybe spark a memory of how to get started, then maybe they can finish it.” The last teacher described how she would differentiate the learning process for students with working memory issues by continuing to use guided practice with the students instead of moving to independent practice where the students may not be able to sort through the information and solve the problems correctly.

Most of the teachers agreed that implementing instructional strategies that address the multiple modalities assists students with memory issues. Two teachers discussed the importance of providing hands-on experiences. The first teacher described using 3-D figures to help students see the sides when calculating surface area. The second teacher described using algebra tiles and balanced scales when solving equations so that students can visually understand the concept of balancing the sides of the equation. One teacher discussed the idea of using mnemonic devices to help basic skills students remember processes or procedures. The last teacher described using several strategies to teach one concept in an effort to reach all learners. The teacher explained, “I also try to present my lessons in different like modalities for all the students. We will do note-taking, but also a little practice problems, and then we will do maybe a video to show the same things.” The teachers agreed that addressing the multiple modalities helps improve the students’ memory and helps students find more mathematical success.

Two teachers mentioned instructional strategies for memory not discussed by the other teachers. The first teacher discussed the importance of using reflection time to improve memory. The teacher explained, “I think the different math logs in theory would be to try to improve short-term memory because again you are making them do that metacognitive piece.” The other teacher commented on the importance of building prior knowledge as a way to improve retention. The teacher shared,

We have done a lot of pre-teaching, exposing them to things that haven’t come up in our direct instruction and kind of giving them little bits and pieces of it along

the way so that as it comes up in more formal instruction they have some background knowledge of it and a point of reference.

Most of the teachers' responses to interview questions about working memory aligned with findings described in the literature review. Teachers agreed that basic skills students display issues with memory, retention, and retrieval, which affected students' ability to perform multiple steps, ignore irrelevant information, and apply information during mathematical tasks. Teachers also supported the research findings that providing teacher feedback, prior knowledge, process steps, and manipulative instruction helps improve memory issues. During the interview process, teachers did not make connections between using illustrations to aid memory or the importance of early detection of working memory issues, which researchers identified as a best practice in the area of working memory.

Research question 3. Responses to interview questions related to problem-solving indicated that teachers agreed that basic skills students struggle with problem-solving, which ultimately affects mathematics performance. The teachers also agreed that all basic skills students demonstrate deficits in the area of problem-solving on a consistent basis. One teacher, when talking about problem-solving, noted that, "There were other students who struggle just as much, but they [basic skills students] all struggle as a population, 100% of them struggle." Another teacher expressed the issue by saying, "I would say problem-solving seems to be a consistent source of an area of weakness, I would say."

The interview data indicated four problematic areas related to problem-solving issues, which emerged into the themes: reading comprehension, multistep problems, conceptual understanding, and approach. The first issue noted by more than half of the teachers connected to reading comprehension. The teachers explained that many basic skills students struggle to understand the terminology in the word problem and to pull out important information from the word problem. One teacher stated that, “They often have a hard time even reading the problem and taking apart what they need to look for.” Another teacher commented that, “They usually have difficulty with the wording aspect in problem-solving. For example, yesterday the word replacement set, the term *replacement set* came up and *solutions*, because you didn't have basic terminology, they struggled.” Other teachers even noted that students struggle to understand the question in a word problem.

The second problematic area identified by one teacher related to multistep problems. The teacher believed that basic skills students struggle to identify the steps needed to solve the problem. The teacher explained, “I have noticed that the multistep problems are difficult for them. They might not be able to determine the first step that is needed and carry it through to the second or third step.”

The third problematic area identified by teachers in the interview sessions related to conceptual understanding of mathematics concepts. Two teachers believed that a lack of conceptual understanding causes basic skills students' issues when the students solve word problems. Both teachers related the conceptual understanding to performing computational procedures needed in problem-solving. One teacher explained that,

“Sometimes they are not able to conceptualize what is being asked.” The teacher related this to an example with area and volume. The teacher explained that students fail to develop an understanding of when you use area versus volume and often use the wrong process during problem-solving. Another teacher described student understanding of operations in problem-solving situations as, “I believe part of the issue is that they don’t have a strong number sense, and so they don’t really understand the meaning behind the operations they are asked to perform with numbers.”

The final problematic area in problem-solving identified by teachers related to determining an approach to solve problem-solving questions. Several teachers discussed the fact that basic skills students struggle to follow a plan when solving word problems. One teacher explained that, “They don’t really have a plan of attack in many cases for problem-solving.” Other teachers explained that basic skills students struggle to organize their work in a way that demonstrates how they solved the problem. A final teacher explained that, “Keeping the information organized can sometimes be difficult, and the thought process isn’t clear if I were to just take their paper and look at it to see how they got to the answer.”

The interview data provided information about instructional strategies the teachers implement to help students during problem-solving tasks, which emerged into the subthemes of reading comprehension, attack skills, real-life tasks, and textbook resources. Teachers discussed employing reading comprehension strategies to assist students in understanding the task, question, important information, and vocabulary contained in the problem-solving situation. Several teachers indicated that they use the

process of highlighting to help basic skills students identify important information. One teacher described the process as, “Along with what the language arts teachers are doing, we have taught them to mark up the text and you know circle important words.” Several other teachers explained the importance of having students stop and summarize the information from the problem. One teacher described the process as,

Having them reframe the information if they are headed in the wrong direction and certainly summarize the information... because often I have found that even if they do get the answer, sometimes it is hard for them to verbalize so that higher level thinking is something that we continually work on.

Other teachers described strategies used to help students focus on vocabulary. The teachers explained that they have students highlight the key mathematical words in an effort to understand the question and mathematical processes needed to solve the problems. One of the teachers explained, “I think that teaching them to pick out the question is important, teaching them to use word phrases to identify the pieces of the problem not just looking for numbers... is helpful for them.” Another teacher commented, “I will try to have them use a highlighter or even just their pencil to um highlight key words, um for example, key words that represent operations like sum, quotient, product.”

The teachers also described strategies used to help students attack word problems. Several teachers explained that they teach students to approach the problem by breaking the problem down into steps. One teacher described the process as,

Just trying to get them to break it down into parts, and if there is more than one question to answer separately, to even number the first question, mark the first question number one, and answer that question first... so that they can kind of break the problem down so they are not so overwhelmed by the task.

Other teachers explained that they taught students to develop a plan prior to starting the problem. One teacher explained, "Teaching them to come up with a plan before jumping to some type of computation is helpful for them." Two teachers discussed how encouraging students to use a visual representation as part of the plan helps many basic skills students during problem-solving. The first teacher commented, "We have also taught them to use drawing a picture strategy." The second teacher noted that the plan might include, "visualizing a situation so if a problem can be drawn, or if you can use a table or graph, something that helps to organize the information."

One teacher mentioned using real-life activities to help students comprehend problem-solving tasks. The teacher explained, "If it is something they have background with, you know, often money problems or things dealing with shopping in some way; they can be more successful than something that doesn't relate to their world in anyway." The teacher added that using video games and other things that students experience in daily life helps students understand the math problems.

Several teachers mentioned using the resources in the textbook series to provide additional support to basic skills students. One teacher discussed using the hands on activities and exploration activities contained in the textbook to help make mathematical problems more concrete and to provide visual examples. Other teachers discussed using

the previous district textbook series to assign the leveled practice sheets, especially the reteach and review for mastery worksheets to help basic skills students get more differentiated practice.

Most of the teachers' responses to the interview questions about problem-solving aligned with the findings described in the literature review. The teachers agreed that basic skills students display deficits in reading comprehension, complex problems, and communicating mathematical thinking, which effects overall mathematics performance. Teachers also supported the view that using real-life problems, teaching reading comprehension skills, building students' repertoire of problem-solving strategies, and providing differentiated practice improves students' problem-solving abilities. Researchers also mentioned that teachers tend to focus more on decoding the problem as opposed to finding multiple solutions. Many of the teachers' responses to problem-solving questions provided me with information to confirm that teachers repeatedly discussed the need to decode the problem, and none of the teachers mentioned the value of finding multiple solutions while discussing the topic of problem-solving. During the interview process, teachers did not make connections between computer mediated instruction or alternative teaching approaches and problem-solving issues, which researchers identified as a best practice in the area of problem-solving.

Research question 4. Responses to the interview questions related to computation indicated that teachers do not agree about the extent to which computational issues affect mathematics performance of basic skills students. A few teachers expressed that all of their basic skills students have computational issues. One teacher noted, "I

would say that they do perform lower than the regular education students by probably on average 10 to 15%” when discussing the computational performance of basic skills students. Several other teachers expressed that computational performance varies with basic skills students. Some teachers noted variations from year-to-year while others noted variations within the current class. One teacher explained, “Before this year, I would have found that, two years ago I had basic skills, and those students didn’t necessarily know their basic math skills, so that was an issue. This year that really has not been that much of an issue.” Another teacher noted,

It varies, I think from student to student. I do have one basic skills student who is very good at her math facts and can then be successful on computational problems. I do have one other student that struggles greatly and affects every problem she tries to do.

A third teacher commented, “It varies. They do better with computation typically than with problem-solving, but a lot of times they make mistakes with their basic facts.” One teacher noted that some students even demonstrate inconsistent performance from day to day. The teacher noted, “I feel as though it is inconsistent performance because it seems as if one day they will know a basic fact and the next day, they don’t have the retention of that basic fact.”

The teachers also indicated five problematic areas related to computation while answering the interview questions, which emerged into the themes of basic facts, multi-step problems, procedural steps, curriculum, and work habits. The first problematic area related to the students’ mastery of basic facts. All of the teachers believed that students

perform better if students know basic math facts. The first teacher noted, “So it can vary, but I think for the most part for what I have seen, overall those students do struggle with math facts and computation.” Other teachers identified which basic facts trouble the basic skills students. One teacher stated, “Ok, so they don’t know their times tables, their division facts, even addition and subtraction.” Another teacher felt that, “multiplication and division are definitely a bigger issue for basic facts than addition and subtraction.” The last teacher explained how basic facts deficiencies affect basic skill students’ progress. The teacher explained,

A lot of times they make mistakes with the basic facts often in a procedural problem that requires multiple steps. You might be able to see that they understand what you taught them, but they have a lot of basic fact errors that led them to the incorrect answer even though their steps might be correct.

A second problematic area mentioned by a few teachers related to multistep problems. One teacher discussed how students need to learn a lot of new information at once to solve computational problems, which cause students to make errors when completing the steps to solve the problem. The teacher stated, “So, I just think there is a lot being thrown at them, and they are trying to remember as much as they can, but sometimes it is difficult because the decimals are a new concept.” Another teacher discussed how computational issues occur in division. The teacher commented, “Long division is difficult for many of them. There are a lot of steps, and it requires them to know a lot of facts at one time.”

A third problematic area in computation identified by most of the teachers related to following the procedural steps to solve computational problems. The teachers discussed the fact that students often confuse processes or even forget steps while solving computational problems. The first teacher commented, “They have a difficult time with division, knowing which number is the dividend, which number is the divisor.” The second teacher explained another example that causes issues for basic skills students,

When multiplying or dividing, so understanding the steps in that. So, the procedure would be multiplying like you would normally and adding up the number of decimal places, meaning the digits to the right, and then adding those and moving the decimal over in the end.

The third teacher explained that basic skills students still struggle with the regrouping concept and all concepts related to decimals. The fourth teacher discussed how basic skills students often forget to use the zero placeholder in multiplication of large numbers, which causes them to add the wrong digits together. The last teacher discussed a place value issue that affects computation. The teacher explained that many basic skills students struggle to subtract a decimal from a whole number. The teacher stated that the students fail to understand that a decimal exists after the whole number and neglect to line the decimals up correctly.

The fourth problematic computational area discussed by most teachers related to curriculum. Many of the teachers expressed that they struggle to cover the curriculum with the amount of time given to teach mathematics. The first teacher expressed issues with pacing. The teacher stated, “I think that they are basic skills for a reason meaning

that things are just more difficult for them and um trying to move at a quick pace and sometimes they only grasp certain things that you say.” Several other teachers discussed issues with the fact that basic facts instruction occurs in the primary years, and that the sixth grade curriculum does not address basic fact standards. One teacher explained, “I think for a lot of them the math facts weren’t practiced at a younger age, so at this point, you know, we no longer practice them. We just assume they know them.” Another teacher stated that, “I think it is something that they definitely, I mean by the time they get to sixth grade, they should have basic facts mastered.” The last teacher explained that, “There isn’t the time for it [basic fact instruction].”

The last problematic area in computation mentioned by teachers related to work habits. Two teachers discussed how reluctance by basic skills students to use strategies affects computational performance. One teacher explained that, “They are reluctant to use the tools that we offer them such as calculators or multiplication charts.” The two teachers discussed how reluctance might relate to the embarrassment of having other students know about the issues. One teacher explained, “Maybe at this point a concept such as long division is thought to be something that should have been mastered already, and I think that when a student feels singled out as not having certain skills that others have, they feel embarrassed.” Another teacher mentioned the idea that a “feeling of repeated failure” might impede the students’ commitment level and intrinsic motivation, which affects computational progress.

The interview data revealed teachers thoughts about the theme of instructional strategies used to improve computational performance. The teachers identified five types

of instructional strategies in the responses to computational interview questions, which emerged into the subthemes of conceptual understanding, direct instruction, feedback, computational tools, and real- life examples. The first instructional strategy related to building conceptual understanding of the computational process. Two teachers described conceptual building during the interview process. The first teacher explained that, “Trying to build conceptual understanding for kids who are struggling to remember steps, making that connection [conceptual understanding] there can help.” The second teacher commented, “I’ve tried re-teaching them; breaking down the numbers into place value to show why we use the placeholder zero. I guess I try to go back to more of the conceptual so they understand the procedure.”

The second instructional strategy mentioned by one teacher related to direct instruction. The teacher discussed using the note-taking strategy during direct instruction to help students remember computational steps. The teacher explained that she uses “A lot of direct instruction explicitly teaching the steps” when describing her computational instruction. The teacher also stated that, “This year I am using an interactive notebook so for procedural concepts; they have the notes right there with them all year long to look back to.” when discussing how she uses notes to help with computation.

The third instructional strategy discussed by one teacher related to feedback. The teacher explained, “I try as a teacher to provide a lot of positive reinforcement to praise students when they go above and beyond, when I see that they have put the effort in.” when describing the strategies the teacher uses to help students improve work habits that affect computational performance.

The last instructional strategy teachers mentioned in connection with computation related to giving students tools to use to improve computation. Table 5 lists computational tools suggested by teachers. All of the teachers mentioned the use of computational tools, but they collectively mentioned a variety of tools. One teacher mentioned using the mnemonic device: divide, multiply, subtract, bring down when teaching division. Another teacher mentioned using base ten blocks to demonstrate how one place does not have enough to subtract from in regrouping, but explained students did not seem to benefit from this strategy. A third teacher explained that she uses chips and counters to teach computational processes but found that at sixth grade the math problems contain large numbers, which makes it difficult to use chips to represent numbers. A fourth teacher addressed how to help students improve basic fact mastery. The teacher explained,

We have also done fast fact practice as well as some fast fact assessment to try to motivate kids, that you know this is something that if you study for, you can get a good grade, and then that would be averaged in with your grades.

Another teacher also addressed improving basic fact issues by explaining, “I have given her five different print outs of time testing for multiplication tables... She told me that her multiplication is improving because she is working on that speed and accuracy.” The last teacher discussed how technology helps to improve computation. The teacher explained that the students use online tools such as Study Island and Cool Math to practice math facts.

Table 5

Computational Tools Used by Teachers

Computational tools	Percentage of teachers who mentioned using the specific tool
Calculator	40%
Multiplication chart	40%
Mnemonic devices	40%
Manipulatives	40%
Flash cards	60%
Highlighter	40%
Number line	20%
Graph paper	20%
Extra practice	100%
Technology	100%
Fast facts assessments	60%

The last instructional strategy teachers mentioned related to real-life learning. One teacher mentioned the use of real-life learning in connection with computational performance. The teacher explained that using a real-life activity helps students see meaning behind numbers. The teacher described teaching students about solving equations with two variables. The teacher provided an explanation,

With the independent variable, we were looking at examples in a pizza parlor and ordering a pizza with a certain amount of toppings. So things are not just numbers and symbols but there is a context behind it that they can grab on to.

Some of the teachers' responses to interview questions about computation aligned with findings described in the literature review. Teachers agreed that basic skills students struggle with computation on some level, which affects mathematics performance for some students. The teachers confirmed literature review findings that computational issues relate to fluency, working memory issues, and reluctance to use strategies. Teachers also supported the view that fluency practice, teacher feedback, direct instruction, computer software, real-life examples, and building conceptual understanding improve computational skills; however, the teachers did not discuss the use of cooperative learning, providing visual representations, or data-driven decision making when talking about the topic of computation directly. The teachers did discuss the struggles associated with providing the time for students to practice basic facts when the skills should have been previously mastered.

Research question 5. Responses to interview questions related to number sense indicated that teachers agreed that basic skills students struggle with number sense, which ultimately affects mathematics performance. One teacher described the issue as, "They have a very difficult time with number sense, which is something no longer in our curriculum at sixth grade." Another teacher explained, "I think they are for the most part missing a like, an overall understanding of numbers and that numbers represent like a quantity." A third teacher described the extent of the problem when stating, "They have

a terrible number sense typically. That is, I think that affects greatly all other areas you mentioned.”

The teachers identified two main problematic areas affected by a lack of number sense during the interview process, which emerged into the subthemes of part whole relationships and integers. The first area identified by several teachers related to the understanding of the part- whole relationship found in decimals, fractions, and percent. The teacher explained the issue by stating that,

You know this kind of makes me think immediately, think of the unit we did on decimals and fractions and trying to rely the message that when you are multiplying with fractions or you are multiplying with decimals that you are finding a part of something.

A second teacher related the issue to understanding the values of fractions, decimals, and percent. The teacher stated that, “I think, well at the sixth grade level, the things that stand out most to me are dealing with fraction, decimals, um percents, just the idea of value. They have a very hard time recognizing the value of a number.” The third teacher related the issue of number sense to mixed numbers. The teacher explained, “They didn’t really have an understanding that let’s say a number like one and two thirds comes in between the whole numbers one and two.”

The second problematic area mentioned by teachers during the discussion of number sense related to the concept of integers. Two teachers described the situation that basic skills students struggle to understand the idea of negative numbers. The first

teacher commented on the idea that basic skills students' do not understand the value of negative numbers by stating that,

This year we had students create number lines, and when they did the positive side, they were ok with that, but then when they did the negative side, they started with larger numbers and went backwards versus putting negative one next to zero. They had negative five right next to zero, then negative four, negative three, negative two, and negative one.

The second teacher commented on the idea that students do not understand the concept of arriving at negative answers when calculating problems. The teacher explained, "So the idea that we did an inequality today, and the idea that you can have seven minus 12 and it goes into negatives. Students were asking, like questioning, um wait can I get a negative."

The interview process also indicated teachers' perceptions about instructional strategies that helped to improve number sense. Teachers identified three specific instructional strategies when working with basic skills students, which emerged into the subthemes of visual representation, technology, and real-life connections. The first strategy related to using visual representations to help students understand the value of numbers. Several teachers discussed the value of using manipulatives when teaching number sense concepts. One teacher gave the example of using money, "I do use money examples a lot of times especially with decimals because they can see the value more when you are talking about money than if you are talking about a number." Other teachers discussed the idea of using a number line to create a visual relationship between

numbers. The teacher explained, “I think a number line is important and then in using that, I either go and visually do it, or I have a number line on their desk and that helps” when describing how to improve number sense of integers.

The second instructional strategy teachers identified to improve number sense related to technology. One teacher discussed how online tools help to model the number sense concepts. The teacher explained that she uses different computer programs, online interactive activities, and hands on labs. The teacher referenced one specific program used to improve number sense called *Understanding Mathematics*. The teacher stated, “It is designed to build the conceptual background for the topic. It models, it will show you real world examples as you are moving through.”

The third instructional strategy teachers identified in the interview process for number sense related to the idea of making connections to numbers. One teacher discussed the idea of making real-life connections. The teacher commented, “They can see value more when you are talking about money than if you are just talking about a number.” Two teachers discussed the concept of allowing the students to make personal connections to mathematical concepts. The teacher explained, “I just try to connect to their lives when it comes to explaining number sense and the specific topic like money. Sometimes, I try to use them [the students] as part of the problem.” Another teacher discussed the idea of connecting the mathematical concept to other concepts in an effort to improve number sense. The teacher stated, “I try to, I guess make connections to other mathematical concepts and then connect that to their lives.”

Some of the teachers' responses to interview questions about number sense aligned with findings described in the literature review. Teachers agreed that basic skills students struggle with number sense concepts of part-whole relationships and rational numbers, which affects mathematics performance. The teachers also supported the literature about the idea that basic skills students struggle to develop a conceptual understanding of mathematical concepts; however, teachers also mentioned number sense strategies not discussed in the literature review. The teachers found success in using visual representations, technology, and real-life connections to help basic skills students build a concept of numbers.

Research question 6. Responses to interview questions related to challenges teacher face when instructing basic skills students indicated that teachers agreed that basic skills student population does pose challenges. Teachers collectively identified 10 challenges in the area of basic skills instruction for the specific setting at this sixth grade middle school. The 10 challenges fit into four subthemes meeting student' needs, curriculum, student attributes, and testing.

The first category related to challenges that arise in connection with students' needs. Several teachers discussed difficulties in meeting basic skills students' needs. One teacher explained, "I think the hardest aspect is having the time to get to all of my students and their needs and meet their needs." The teacher explained the reasoning behind the challenge as, "I think time constraints hold me back from being able to reinforce and reteach and review and practice the

information with the students who probably need it the most.” Another teacher described the hardest aspect as, “filling in the gaps of their prior knowledge and also sometimes as far as problem-solving determining what they don’t know.” The teacher explained that basic skills students often leave word problems and multistep problems blank, which makes it hard for the teacher to identify the issue as reading comprehension, math skill, or strategy based. The teacher stated that, “Sometimes determining what needs to be addressed can be an issue with those students.” One teacher suggested that she would like more professional development on differentiating instruction to help meet students’ needs.

The second category in challenges teachers face in teaching basic skills students related to curricular challenges at the middle school setting. Teachers discussed issues associated with the Common Core Curriculum and class arrangements. Several teachers discussed the idea that the new standards do not include instruction at the sixth grade level for some of the common deficit areas of basic skills students. One teacher explained that, “number sense in terms of place value is no longer included in sixth grade Common Core Curriculum were it was included somewhat in the New Jersey State Standards that we had been using up to this point.” Another teacher discussed that,

The curriculum is assuming they already have an understanding [of number sense] with which some of them, many of them don’t. So, you know we try to address it as best we can and use manipulatives to show them that, but it does present a problem because even though it is not in

our curriculum, it is you know a basic level of understanding that they need to have for math.

Another teacher expressed the challenge of presenting all of the required sixth grade curricular standards. The teacher explained that because the students struggle with retention, “It is difficult for us to make progress in our instruction and to move from one concept to another in a timely fashion in order to make sure students have mastered all of the skills they are required to have mastered by the end of the year.” The teacher also expressed that, “We seem to spend half of the period re-teaching material that is expected to have been already mastered.” The teacher also discussed the issue of time. The schedule at the middle school under study includes 55- minutes for mathematics instruction. Several teachers mentioned that they struggle to complete a Do Now, review homework, teach a lesson, provide guided practice, complete independent practice while also meeting the needs of students. One teacher explained,

I find that I don’t have as much of an opportunity to provide the instruction I need to and students don’t have enough time to work independently practicing new skills because their seems to be so much that we need to be able to fit into a 55-minute period.

The teacher attributed the situation with the issue that

Many students don’t master the concepts so when they go home to work on homework independently, they come in the next day, rather than reviewing the answers, and answering a question here or there, we almost have to redo every single problem as a whole class.

Another teacher stated,

I think that the time allotted for each period is just not sufficient by the time you go through a Do Now, you review homework, and you do lesson examples. There is not enough practice time, and then there is not enough time to pull small groups on the practice that you see the students doing.

Another teacher expressed a desire for professional development in the area of instruction of basic skills students to improve her knowledge of additional strategies. The teacher stated, “I feel like I don’t really have additional, during a lesson, I feel like I just present all my students with my bag of tricks.”

The final challenge in regards to curricular issues related to the class arrangements. The teachers explained that the administration levels the mathematics classes. Several teachers explained that basic skills students end up in the lowest two levels; but that the majority ends up in the lowest level. Teachers explained that this design creates the situation where the entire class consists of struggling learners. One teacher explained,

So most of the basic skills students I worked with have been in the lowest level, which means the class is made up of pretty much all basic skills and special education students. And even the students that maybe in there that don’t actually have a label attached to them are very low math learners.

Another teacher expressed the situation as, “So this year I teach an in-class support level...In that class there are all learners, I would say all of the learners are struggling

math learners because they are leveled and that is how they are placed into the class.” A third teacher explained the scenario by stating,

So my basic skills math students, which you know, I do have relatively large groups in each class, are also in class with other struggling learners whether they are already identified as students who have learning disabilities... or students that may or may not have already been identified for other services.

The teachers also explained how the leveled classroom atmosphere creates challenges during instruction. Several teachers discussed the difficulty of meeting students’ needs. One teacher commented, “It’s very difficult to meet individual needs when you feel as though every child in the class has severe individual needs.” The teacher also explained that it is difficult to tier instruction, meet with small groups, and use student-centered activities when so many students need help on mathematics concepts. Another teacher addressed the issue of cooperative learning in leveled classes. The teacher explained,

It is hard to use any sort of peer model or grouping strategies because it is so homogenous, and you don’t have any real leaders that could be the leader so you could try to work individually. No one really takes control, and they still need a teacher throughout.

The last teacher explained how leveled classes might affect work habits of basic skills students. The teacher explained, “Sometimes it is almost a sense of demotivation because they don’t have those models to look toward that are using good math strategies, or you know, are using good mathematical practices in their work.”

In contrast, teachers who worked with students in the higher of the two lower level classes described experiences with basic skills students differently on certain topics. The teachers agreed that basic skills students struggle with problem-solving, number sense, and working memory regardless of the level of the class; however, the teachers noted differences in the areas of computation and self-efficacy. The teachers reported that basic skills students in the higher leveled classes do not experience as many issues with basic fact mastery and self-efficacy. One teacher, however, stated the basic skills students in the lower leveled class did not demonstrate signs of self-efficacy issues because the basic skills students fit in with the other students in terms of performance. For the most part though, teachers did note higher levels of self-efficacy for basic skills students in the higher leveled classes. One teacher commented on the difference in success between the basic skills students in the different leveled classes. The teacher stated,

I would say last year, I actually had a few students not in that [lower level] class. They were in the higher level class. Those were my successful basic skills students. They ended up exiting out [of the basic skills program], or they made progress on their NJ ASK. I think it [the higher level class] offered them the peer, the peer modeling, and I think I could more, I could meet with them individually a bit more than I could my other class because I did have other students that could work more on their own.

The third category for challenges teachers' encounter when instructing basic skills students related to student attributes. One teacher expressed the idea that basic skills

mastery is an area of frustration. The teacher explained, “when they don’t know their basic facts coming into sixth grade” as “a little bit frustrating because as a parent, I know what I do with my kids and in first grade we are going over them now.” Another teacher stated that when students struggle with retention it is challenging. One teacher described the situation as “They um have a hard time retaining the information, and you can get to the point where you really feel like they understand it, but then a few days later it seems like you are back at square one.” The final teacher discussed how lack of effort causes challenges. The teacher shared, “So that can become frustrating when you try to pull all of your energy and your resources into helping a child who sometimes doesn’t want to be helped.”

The final category under the concept of challenges in teaching basic skills students related to testing. One teacher discussed the frustrations attached to working with students who do not demonstrate progress on assessments. The teacher explained,

The low gains that you see in testing could be one of them [hardest aspect of instruction]. Although the kids may be comprehending, and you may be assisting them and helping them, and that’s great, the scores for basic skills kids tend to not rise as high or by as much as your higher level students.

One teacher discussed the desire for professional development in the area of instruction of basic skills students because the teacher found it difficult to attend to different personalities, levels, and thought processes of basic skills students and achieve significant gains on standardized tests.

During the interviews, teachers offered suggestions on how to overcome challenges of working with basic skills students. One teacher suggested befriending basic skills students by finding out more about students' personal life and interests and then referring to some of the personal facts when teaching mathematics skills. Two teachers proposed the idea of changing the way administrators design classes. The first teacher commented, "I think that it would be beneficial if we had longer class periods, and I think also if the class sizes were smaller it would be easier to meet the individual needs of students." The second teacher recommended blending the two lower level classes. The teacher explained, "I think the blending of the 6A and 6B would help get some more peer models in there to help struggling students and allow the teachers to be able to use more grouping strategies."

Some of the teachers' responses to interview questions about challenges teachers encounter when working with basic skills mathematics students aligned with findings described in the literature review. Teachers agreed that school systems should address number sense and basic fact issues in elementary school. Teachers confirmed the literature review findings that teachers may not feel prepared to meet diverse mathematical needs of students. Teachers also supported the view that leveling mathematics classes may be detrimental to students' performance.

Observational Findings

During the observational process, I learned about teachers' instructional habits when working with basic skills students. The observational data helped to validate teachers' perceptions about problem-solving, number sense, computational, self-efficacy,

and working memory mathematics instruction of basic skills students discussed by teachers during the interview process. The data analysis themes of extent of the problem, problematic areas, and instructional strategies that emerged from the common interview responses also emerged as common themes during teacher observations. Observational data also provided information that confirmed additional themes described under each research question in the interview data. The color-coded responses and circled codes evident on interview transcript and observational tool helped to confirm the themes of extent of the problem, problematic areas, and instructional strategies.

Research question 1. I was able to confirm interview and research findings that basic skills students struggle with self-efficacy issues with the observational data. I noted an example of students comparing grades, which supported the theme of performance pressure. One teacher gave back test scores, and I noted that some students discussed the scores with other students while other students put the test face down on the desk and did not share the test score. I also noted several instances where students displayed the subtheme of the low self-efficacy characteristic of not completing work while solving a problem. In one classroom, I noted that the teacher addressed a group of students who failed to work on a cumulative review packet. The teacher removed a student from the group and told him to, “Please go sit by the computers” in an effort to get the student to focus on the work. In several classrooms, I noted that many teachers discussed the issue of not providing the work needed to solve the problem with students. In one classroom, the teacher reminded a student to record work during a group activity

on surface area. In another classroom, the teacher reminded a student to record work while completing the problem of the day.

I also noted examples of teachers using instructional strategies to build self-efficacy levels. The examples noted supported the subthemes of positivity and feedback. Table 6 lists the extent to which teachers implemented the instructional strategies. I observed several examples of the practice of positive reinforcement mentioned in the interview process. Two teachers praised students for asking for help. The first teacher stated to the whole class, “He [a student] had a question, he raised his hand for me to come help him.” Another teacher acknowledged a student for asking a question by stating, “Oh, yes. Good question.” Other teachers gave compliments to students for content-related efforts. One teacher explained to students, “I love that you used vocabulary.” Another teacher commented to the class, “I have to compliment a couple of people who couldn’t do this [calculations] in their heads. They wrote it off to the side.” A third teacher explained, “Some of us used our resources, B got up and got a calculator to check his work.” The teacher gave the student a pirate point to reward the behavior. A final teacher provided praise for participation. The teacher explained, “I love that you said you didn’t understand, and how your hand shot up.”

Table 6

Implementation of Research-Based Best Practices

Consistent evidence of implementation	Some evidence of implementation	No evidence of implementation
Self efficacy Positivity Feedback	Self efficacy Setting high expectations Cooperative learning Rewards Student choice Alternative approaches Humor Politeness	Self efficacy Adventure learning
Working memory Note taking Multiple modalities Guided instruction Activate prior knowledge Questioning technique	Working memory Reflection Cooperative learning Mnemonic devices Manipulatives Number lines Grid paper	Working memory Early detection strategies Illustrations
Problem-solving Reading strategies Highlighting Summarizing Decoding vocabulary Creating steps and plans Textbook resources Questioning techniques Cooperative learning	Problem-solving Visual representations Real-life examples Hands on activities Explorations Leveled practice Differentiation Multiple strategies Computer-mediated tasks Flipped classroom Alternative approaches Metacognition Discussing misconceptions	Problem-solving
Computation Technology use Extra practice Direct instruction Feedback Guided practice Questioning technique Calculator use	Computation Fast fact practice Mnemonic devices Targeted practice Manipulatives Highlighting Multiplication charts Independent practice Note taking Number lines Graph paper Real-life examples Cooperative learning	Computation RtI Illustrations
Number sense Visual representation Manipulatives	Number sense Number lines Technology use Real-life connections	Number sense Number sense games

I also noted examples of teachers using feedback to build self-efficacy levels, which teachers mentioned during the interview process. Some of the examples noted related to students who gave incorrect answers. The first teacher commented to the student privately, “That is smart, very smart but something happened here” while going over practice problems. I noted a teacher conducting a class discussion about vertices, edges, and faces. The teacher engaged students in finding examples of the terms around the room. One student identified the wipe board. The teacher commented, “That is not 3-D, but you are getting there.” In another example, one student gave an incorrect. The teacher asked the student a question to redirect the student. The teacher asked, “What does it mean to simplify?” The question prompted the student to correct the mistake.

Some of the examples of using feedback to build self-efficacy levels related to students giving correct answers. One teacher involved students in the process of justifying solutions with classmates in an effort to reach agreement about solutions. The teacher announced to the class, “He did a nice job defending his mathematical position and changed the minds of L and T.” The class clapped, and the student received a pirate point. In another lesson, the teacher pulled two basic skills students to the side to compliment them on the way they recorded their work to solve equations. The teacher then gave the students a choice about how to spend their time while the teacher reexplained the process to the rest of the class.

I noted other strategies that teachers used to build self-efficacy that teachers did not mention during the interview process. Several teachers used humor when addressing students. One teacher engaged students in a discussion about 3-D figures. During that

discussion, the teacher asked students to identify examples of faces. The teacher stated, “Give me faces, and I don’t mean yours.” The class laughed. Another teacher held a discussion about reflections. A student explained when reflecting over X, Y stays the same and X changes. The teacher responded by saying, “You got it chickie.” One last example related to student participation. The teacher commented that, “This side is on fire today, this side looks fast asleep.”

I also noted examples of teachers speaking to students with politeness. In every lesson observed, I heard the teacher speak to students using polite phrases. The teachers used the phrases “Yes Sir,” and “Ladies and Gentlemen.” Several teachers also greeted students when students arrived to class. Two teachers waited at the door, smiled and stated, “Good Morning” in all three observations. One teacher ended all three observations by stating, “Have a great day.” Another teacher began the class by greeting students in the following way, “Ladies and Gentleman, come in, sit down, and get started.” Another teacher used the phrase, “Thank you for your honesty” several times during the class period when students would let the teacher know they got a question wrong.

I also noted an example of a teacher implementing an alternative instructional approach to teach equation concepts. The students participated in a collaborative project to determine the best game app based on revenue, installs, and cost. Researchers identified alternative approaches as beneficial in building self-efficacy as the activities helped students relate to the topic and feel competence while playing a role to complete the assignment.

I noted behaviors during the observational process that aligned with the comments made about self-efficacy by teachers in the interview process and discussed in the literature review. The observational data indicated that basic skills students with self-efficacy issues demonstrate negative work habit characteristics, such as lack of work ethic, and feel pressure to perform as well as other students in the class. The teacher behaviors during the observational process also supported the instructional strategies of positivity and feedback to improve self-efficacy. I noted additional strategies not mentioned in interview data or literature review. I witnessed teachers using humor, politeness, and rewards to build classroom environments that promote high self-efficacy levels of basic skills students.

A comparison between the observational data, interview data, and literature review indicated a discrepancy in areas of alternative teaching approaches and cooperative learning. Researchers suggested that student-centered learning and cooperative learning tasks provide opportunities for struggling learners to be successful when completing mathematical tasks. As mentioned in the interview section under research question six, teachers perceive that basic skills students lack the skills needed to participate in student-centered learning tasks. The observational data confirmed provided evidence that teachers do not consistently implement student-centered practices in that I noted only one example; therefore, a gap in practice exists in the area of student-centered learning.

Research question 2. I noted several instances where students struggled to recall processes, which validated teachers' beliefs and literature review findings that working

memory issues affect basic skills students. I noted an example of when one student struggled to retain information within a class period. The teacher explained the process of reflecting a point over the X-axis. The teacher explained that X stays the same and Y changes. Students practiced several problems reflecting a point over the X-axis. The teacher then explained how to reflect a point over the Y-axis. The teacher described that Y stays the same and X changes. Students then completed practice problems of reflections of points over both the X and Y-axis. When completing the problems, one basic skills student forgot what to do with the X-axis, which the teacher modeled first during the lesson. I also noted another student who failed to retain a concept from a previous lesson. The student stated to the teacher while completing the cumulative review packet, "I forgot what prime is." I also noted an example of several students struggling with retention of fraction concepts. Students failed to remember how to convert a fraction with a denominator of four into a decimal.

I noted examples of students struggling to apply processes to new situations, which teachers mentioned in the interview process and researchers identified as an issue. I recorded one teacher going over homework and commenting, "We learned how to add and subtract fractions and decimals, so you just have to apply the same rules to the equations." I also recorded another teacher going over homework and stating, "What makes these volume problems different than what you are used to" when addressing common mistakes with the students.

I noticed examples of students confusing processes as teachers noted in the interview data and researchers identified as problematic. One student solved eight to the

third power by multiplying eight times three, and another student made the same mistake with six to the second power when solving equations. Other students failed to remember how to solve the equation $3(2-n)$. The students did not remember what to do with a number outside of the parentheses. Another student confused positive and negative numbers when creating a number line. In one classroom, the students confused steps in solving equations. I noted that the teacher stated to the students, "I saw some people write the check as the solution. The check is not the solution. The check is just a way to make sure the solution is correct." I documented that other students struggled to follow the steps of order of operations when solving equations. The students tried to solve the equation 24 divided by four plus six. Several students added four plus six first instead of dividing 24 by six. The final example I noted related to area. A student identified the area of the shape as 126 cubic units confusing area units with volume units.

I also documented several examples of teachers using instructional strategies to improve the working memory of basic skills students, which related to the subthemes of note taking, guided practice, reflection, prior knowledge, and multiple modalities. Table 5 lists the extent to which teachers implemented the instructional strategies. In 10 observations, I recorded that teachers used the note taking strategy. One teacher had a student look in the textbook to review notes on a topic the student did not understand from a cumulative review packet. I recorded that several teachers required students to copy teacher notes during the lesson. I also made note that one teacher asked students to take out their notebook to look up the answer to the question, "What does it mean to simplify."

I recorded 50 examples of teachers using the concept of guided practice to help students recall information. I noted the guided practice examples during Do Now, homework review, and after initial instruction of a new concept. One teacher used guided practice to encourage students “to follow every single step, show how you isolate the X” when teaching students how to solve equations. Another teacher used the smart board to model the process of reflecting a point over the X and Y-axis. I noted that the teacher then had students solve a few problems while the teacher walked around the room to assist students. Several teachers modeled the solutions to the Do Now by guiding the students through the process to find the solutions through a question- answer- discussion format. I also noted that two teachers shared the answers to homework in all three observations by modeling the solutions through a question- answer- discussion format. One teacher commented,

I am only going to go over number one and two of the homework to remind you of what you should be doing when you see a word problem, which is to show word form first before jumping into numbers.

The teacher then proceeded to explain the solutions to the problems through a question answer discussion with the students.

I documented examples of how teachers engaged students in reflection activities to help improve retention. One teacher asked students to “take a minute to add notes to our OMG [outstanding math guide] notebooks from what you took from the daily math stretch problems.” Another teacher used cooperative learning to allow students to share what students learned from the video on solving equations.

I noted eight examples of teachers using prior knowledge to help students improve retention issues as mentioned in the interview process and in the literature review. One teacher asked students the question, “Have you seen these symbols before? What do they mean?” when introducing an inequality. The teacher asked students to come up with a definition of what students thought the term meant based on what they knew. Another teacher engaged students in a brainstorming activity to formulate a definition for the terms *independent* and *dependent variable*. A final teacher asked students to share what they thought the term *reflect* meant.

I noted seven examples of teachers using multiple modalities to help students improve retention as mentioned in the interview process. Two teachers used the mnemonic phrase *PEMDAS* (parentheses, exponents, multiplication, division, addition, subtraction) to help students recall the steps to solving an equation. One group of students struggled to simplify an expression that involved simplifying two exponents and dividing by ten. The teacher referred the students to *PEMDAS* and led the students through the steps. Two teachers used number lines to provide a visual representation of numbers. One teacher used the number line to model the concept of negative four, and another teacher used the number line to help students identify which numbers satisfied an inequality. An additional teacher created a tree symbol to help students remember the process of prime factorization. A final teacher used graph paper to allow students to create a net for 3-D figures to help students calculate surface area. I also noted the use of manipulatives. One teacher used hands on 3-D shapes in all three lessons to help students

identify the number of faces when calculating surface area. The teacher made reference that students could use graph paper for the upcoming chapter test.

I noted one instructional strategy used by teachers to improve retention that teachers did not mention in the interview process, and I did not include in the literature review. I noted that every teacher used the questioning strategy to help students retrieve information about how to solve math problems. One teacher asked a student, “Five and a half is between what two whole numbers” when the student stated that she did not understand how to graph five and a half on a coordinate graph. Another student identified the units for area as cubic units. The teacher asked the student, “What is the difference between volume and area?” Another student struggled to find a percent of a number. The teacher asked the student, “How is percent related to fractions and decimals?” A group of students struggled to apply knowledge about equations to set up an equation when determining the best app. The teacher asked the students a series of questions to help them set up the correct equation. The teacher asked, “How much is one topping? Two toppings? Three toppings? How will you determine the answer to that?”

I noted behaviors during the observational process that aligned with comments made about working memory by teachers in the interview process and discussed in the literature review. The observational data indicated that basic skills students struggle to retain concepts within a class period and from day to day. The observational data indicated that basic skills students struggle with working memory issues of applying information and confusing processes. The teacher behaviors during the observational process also supported instructional strategies of note-taking, guided practice,

cooperative learning, and building prior knowledge to improve working memory. The observational data also indicated that teachers use reflection and multiple modality activities to help students improve working memory. I also noted an additional strategy not mentioned in the interview data or literature review. I witnessed teachers using higher level questioning to help students retrieve information.

Research question 3. Observational data provided evidence to confirm interview and literature review findings that basic skills students struggle with problem-solving issues. I noted several examples of students struggling with reading comprehension issues while solving word problems as teachers mentioned in the interview process. The students in one classroom struggled with vocabulary in that students did not comprehend the phrase “two times the price.” I noted another example where several students in the class failed to complete all of the steps in a multistep word problem. The problem gave students information that one third of the total flowers were roses and that there were 12 roses. The question asked students to determine how many flowers were not roses. The students multiplied 12 times three to get 36. Students failed to understand that 36 represented the total flowers and to complete the second step of subtracting 12 from 36 to figure out the amount of other flowers. Other students failed to solve a word problem that required a conceptual understanding of area. The problem required students to find the length of a shape given the area and width. The student multiplied the area times the width. The student applied the formula in a rote manor instead of conceptualizing the problem. Another student struggled to solve a word problem involving the least common multiple because the student did not know how to determine the least common multiple.

The student tried to create a list of multiples for both numbers but struggled to arrive at the answer. The teacher suggested that the student try prime factorization instead.

I also noted examples of teachers using instructional strategies to improve students problem-solving abilities that were mentioned in the interview process and identified in the literature review. The data supported the subthemes of reading comprehension, attack skills, real life, textbook resources, and multistep problems. Table 5 lists the extent to which teachers implemented the instructional strategies. I recorded 19 examples of teachers using reading comprehension strategies during problem-solving instruction. Table 7 lists the percentage of teachers who used each reading strategy. One teacher highlighted key terms to help students comprehend the information. The teacher stated, “The reading is tricky here because of the word “it,” which refers to the panther not the mocking bird.” Another teacher pointed out that the phrasing “has a one-half foot wide” used in the problem “is different than the usual wording of the width is one-half foot.” A final teacher highlighted important information in the problem and focused on the wording by saying, “The important language in this problem is three times” to help students determine what operation to use to solve the problem.

I also recorded examples of teachers helping students solve multistep problems. Two teachers modeled common misconceptions made by students when solving problems to help students see what steps basic skills students failed to include in the problem-solving process. One teacher modeled the solution to the problem, “One third of the flowers were roses. There were 12 roses. How many of the flowers were not roses?” and explained the errors involved in the incorrect answer of 36 and four.

I noted eight examples of teachers helping students create a plan to solve a word problem by modeling the use an equation strategy. One teacher used a word problem that required students to determine the height of a mocking bird given the following information, “The panther is 20 inches taller than it [mocking bird].” The teacher modeled how to set up an equation to solve the problem. Another teacher helped students set up an equation to find the best app based on install totals, revenue, and price. The teacher used the equation revenue equals installs times price and pointed out how this one equation would help the students to find the answers to all the questions regardless of what the questions asked for by simply plugging in the numbers and using a variable for missing information.

I noted other instructional strategies teachers implemented during problem-solving instruction that teachers did not mention during the interview process. Several teachers used cooperative learning as a tool to help students solve problem-solving tasks. All of the classrooms arranged desks in groups of two to six. One teacher had students work as a group to identify all numbers that satisfy the inequality statement. Another teacher allowed students to work in groups to complete a surface area activity to draw nets and calculate surface area. A third teacher had students work in groups to collect and analyze data to determine the best game app. A final teacher allowed students to discuss answers to homework questions on coordinate graphing in order to reach an agreement about the correct answer.

Teachers also used questioning strategies to help students solve problem-solving tasks. One student struggled to find a percent of a number. The teacher led the student

through the problem by asking the student to define the term *percent* and by posing the question, “How is percent related to fractions and decimals?” Another teacher helped a student solve a word problem involving the phrase “the price of the apple was two times the berries” by asking the student, “What is the price of the berries?” I also documented that one teacher used a real-life learning activity to help students understand how to use an equation to find best deals. The teacher engaged students in an activity where students pretended to work for goggle and worked as a team to determine the best app based on revenue and install amounts.

I noted behaviors during the observational process that aligned with the comments made about problem-solving in the interview process and data in the literature review. Observational data indicated that basic skills students with problem-solving issues struggle with reading comprehension, decoding mathematical phrases, completing multi-step problems, and building a conceptual understanding. Teacher behaviors during the observational process also supported instructional strategies of decoding terms, highlighting important information, and using real- life connections to improve problem-solving abilities. I noted additional strategies not mentioned in the interview data. I witnessed teachers using cooperative learning, questioning strategies, and modeling misconceptions. I did not notice examples of teachers using hands on practice or supplemental textbook resources such as math labs and leveled-practice sheets.

A comparison between the observational data, interview data, and literature review provided information that confirmed a reading deficit among basic skills students. Teachers mentioned the challenge of meeting students’

mathematical needs and filling mathematical gaps of basic skills students in the limited time given to teach mathematics. Based on the reading issue present in the data, teachers also implement instructional strategies to fill reading gaps during mathematics. To fill the reading gaps teachers provide instruction for additional common core curriculum standards; thus increasing the curriculum load for teachers.

Table 7

Reading Comprehension Strategies Implemented by Teachers

Reading strategy	Percentage of teachers using the strategy
Mark up the text	100%
Summarizing	60%
Vocabulary	100%

Research question 4. Observational data provided information to confirm interview and literature review findings that basic skills students struggle with computational issues. The observed behaviors represented examples of the subtheme procedural problematic areas. I noted several examples of students struggling with procedural issues while solving computational problems, which was mentioned in the interview process. I recorded five examples of students making computational errors while solving multistep problems. One student struggled to solve the problem X divided by six equals 18. The student solved the problem by dividing 18 by six instead of multiplying each side by six. Another student struggled to solve an equation that

required students to first solve the inside of the equation and then multiply that by the number outside the equation. A third student struggled to reflect a point over the X-axis then the Y-axis creating a two-step process.

I also documented seven examples of students making errors in following operational procedures. One student thought the answer from the check step in solving an equation was the answer to what the variable represented. Another student incorrectly answered an equation by adding four plus six first instead of dividing 24 by four. A third student struggled to follow the formula for calculating the area of a trapezoid. A final student failed to use the formula for surface area correctly. The student did not understand the idea that the top and bottom of a pyramid contained the same shape, the front and back had the same shape, and the two sides had the same shape; therefore, the student did not calculate the surface area by finding the area of the bottom and multiplying by two, then doing the same for the front and side.

I noted two computational issues that teachers did not mention in the interview process. Two classrooms of students struggled to follow directions when completing computational problems. One classroom did not read the directions; therefore, used the wrong information to calculate the answer. Another group of students did not follow the teacher's directions to set up an equation first; therefore, struggled to find calculations for revenue. I also documented work habit issues that caused students to make errors in computation. One student calculated the answer for volume mentally instead of recording the work. Another student did not record work for long division. A final student did not record work for plugging in a variable to solve an equation.

I also noted examples of teachers using instructional strategies to assist students in solving computational problems, which were mentioned during the interview process and identified by researchers as effective practices. The examples represented the subthemes direct instruction and computational tools. Table 5 reveals the extent to which teachers implemented the instructional strategies. Several teachers used direct instruction to model the processes needed to solve problems. One teacher modeled the process of solving an equation in all three observations. The teacher demonstrated to students how to solve three problems then allowed students to try three problems while the teacher walked around the room providing feedback. Another teacher provided direct instruction by modeling the solutions to three problematic homework problems related to area. The teacher provided guided practice after modeling how to find volume by letting students try a few problems while the teacher walked around providing feedback. A final teacher used direct instruction to model how to reflect a point over the X and Y-axis. The teacher then had students solve eight problems while walking around to assist students and answer questions. I also noted several examples of teachers modeling solutions for students while going over answers to problems in the Do Now and while going over homework. One teacher modeled the solution to finding the area of a trapezoid. I noted two teachers implementing independent practice. One teacher created a closure to find the volume of a given cube, and the other teacher allowed students to work in groups to calculate the revenue for apps.

I documented three examples of teachers using the questioning technique to improve computation by building conceptual understanding. One teacher engaged

students in a discussion about how to solve an equation. The teacher posed the question, “How would a subtraction equation be different [than an addition equation]?” Another teacher engaged students in a discussion about finding surface area and volume of 3-D shapes. The teacher posed the question, “What is the difference between cube and rectangular prism?” A third teacher held a class discussion related to equations, and the teacher posed the question, “What does it mean to simplify an expression?”

I also noted examples of teachers using computational tools to help students improve computation. Two teachers reminded students to use the mnemonic device PEMDAS when solving equations. Several teachers referenced the use of a calculator to check answers to homework, classroom, and cumulative review problems. One teacher reminded students to use the multiplication chart in the agenda notebooks when students experienced difficulty remembering basic facts. Another teacher helped a student remember steps for solving an equation by sending the student to check previous notes in the student’s interactive notebook. I noted three examples of teachers using manipulatives to help students with computation. One teacher used visuals of 3-D shapes to model the process of counting faces and calculating surface area. The same teacher used graph paper to allow students to trace nets of 3-D shapes to calculate surface area. The teacher mentioned that students could use nets on the chapter assessment. Another teacher drew a number line on the board to help students understand how to solve the problem 56 minus negative four.

I noticed other instructional strategies teachers used to improve computation not mentioned by teachers during the interview process. Two teachers used technology to

allow students to watch tutorial videos for solving equations and finding surface area and volume. The first teacher allowed students to watch tutorials in class, and the second teacher allowed students to watch tutorials for homework. I also noted that two teachers used real-life examples to help students understand computational problems. The first teacher used the example of amusement park ride requirements to explain the idea of the inequality less than or equal to 50. The second teacher allowed students to point to examples of faces, edges, and vertices in the classroom. I also recorded five examples of teachers using cooperative learning to help students with computation. Two teachers allowed students to discuss answers to homework questions on surface area and reflections. Another teacher allowed students to work in groups to determine numbers to satisfy an inequality.

I noted behaviors during the observational process that aligned with comments made about computation in the interview process and data in the literature review. The observational data indicated that basic skills students with computational issues make errors when completing procedural tasks and multistep mathematics problems. I identified two problematic areas in computation not mentioned by teachers: following directions and writing out the work required to reach a solution. Teacher behaviors during the observational process also supported instructional strategies of direct instruction, teacher feedback, guided practice, questioning, modeling, and independent practice to improve computation. I also noted teachers using computational tools such as calculators, mnemonic devices, multiplication charts, note taking, and manipulatives to help

students improve computation. I noted additional strategies not mentioned in the interview data or literature review. I witnessed teachers using technology, tutorials, real-life connections, and cooperative learning to build computational abilities of basic skills students.

A comparison between the observational data, interview data, and literature review provided information to illuminate a discrepancy in the area of mastery of math facts. Researchers suggested that data driven, targeted practice be used to improve basic fact retention. The interview data revealed that teachers' perceived that time constraints prohibited practice of basic facts. The observational data indicated that teachers did not implement basic fact practice since I recorded no evidence of students practicing facts; therefore, a gap in practice existed in the area of basic facts.

Research question 5. Observational data provided information to confirm interview and literature review findings that basic skills students struggle with number sense issues. I noted 10 examples of students struggling with number sense issues during observations, which verified the subthemes part-whole relationships and integers. I noted examples where students struggled with part-whole relationships as mentioned by teachers in the interview process and in the discussion of the literature review. The examples related to understanding decimals, fractions, and percent concepts as teachers suggested. One group of students solved a problem to find the number of ships. The students failed to round the answer 382.353 to 382, and the teacher explained that, "You can't have 0.353 of a ship." Another student struggled to complete a reflection because

the problem involved a fraction, and the student did not understand how to plot five and a half on the coordinate graph. A final student did not understand the process of finding a percent of a number. The teacher reviewed with the student how to turn a fraction into a decimal in order to calculate the answer.

I also noted a number sense issue during observations not mentioned by teachers in the interview process or in the literature review discussion. In two examples, students struggled to understand mathematical phrases to represent values. In one example, the teacher engaged students in a discussion about how to use an equation to solve a word problem. The phrase “20 inches taller” appeared in the word problem. The teacher explained the phrasing to students and pointed out how to determine the bigger object. The second example contained the phrase “50 inches taller.” The teacher also explained the phrase to students.

I documented four examples of teachers using instructional strategies mentioned in the interview process to help students improve number sense. The examples illustrated the subthemes: visual representation and real-life connections. Table 5 lists the extent to which teachers implemented the instructional strategies. Two teachers used number lines during instruction. One teacher used a number line to model the concept of subtracting a negative number, and the other teacher allowed students to use a number line to determine which numbers satisfied an inequality. I also noted that one teacher implemented real-life connections to help students understand the problem. The teacher related inequalities to amusement park ride requirements, “must be below 50 inches to ride” and age limits for children’s games, “must be seven and up to play.”

I noted that one teacher used the questioning technique, not mentioned by teachers during the interview process, to help students improve number sense. The student struggled to understand how to plot five and a half on a coordinate grid. The teacher posed the question, “Five and a half is between what two whole numbers?” to help the student understand where to place a mixed number on an axis. I also noted that a teacher implemented the strategy of estimating to determine reasonableness to help a student improve number sense. A student struggled to find the answer to a decimal multiplication problem. The teacher allowed the student to estimate the problem by rounding to the nearest whole number first, and then compare the rounded answer to the student’s calculated answer to help the student determine the error and find the correct answer.

I noted behaviors during the observational process that aligned with comments made about number sense in the interview process and data in the literature review. The observational data indicated that basic skills students with number sense issues struggle with understanding part-whole relationships and rational numbers. The teacher behaviors during the observational process also supported instructional strategies of using number lines, real-life connections, and the questioning technique to improve number sense of basic skills students. I noted additional strategies not mentioned in the interview data. I witnessed teachers using estimation to determine the reasonableness of an answer. I did not notice use of technology to specifically support number sense as teachers suggested in the interview responses.

A comparison between observational data, interview data, and literature review provided information to illuminate a discrepancy in the area of providing number sense practice. Researchers suggested that daily practice through implementation of number sense games improved number sense. I noted integrated number sense practice embedded in daily work for other mathematical skills, but I did not record any practice designed specifically for number sense; therefore, a gap in practice existed in the area of number sense practice.

Research question 6. Observational data indicated that teachers encountered challenges while working with basic skills students. I noted an example of basic skills students making low gains as mentioned by one teacher when responding to the interview question related to challenges. The students took a chapter assessment on solving equations. The teacher split students into groups for reteaching based on performance. More than half of the class fell into the two lower performing groups because students scored in the 70s or below. I noted that the teacher spent the majority of the class period reviewing answers with students.

I also noted examples of teachers spending class time reviewing homework and Do Now answers. In 12 of the observations, teachers spent a portion of class going over answers to Do Now and homework questions. In observations, teachers spent on average approximately half the period, about 27 minutes, going over Do Now and homework as one teacher suggested. Several teachers mentioned the issue of a lack of time to meet students' needs while also including a Do Now, going over homework, providing a lesson, and giving guided and independent practice during the interview process. I noted

examples of the issue in that teachers did not always provide guided or independent practice in each lesson. One teacher provided guided and independent practice in two out of the three observations. One teacher provided independent practice but not guided practice in all of the observations. Several teachers provided guided but not independent practice in all three observations. I also noted examples to support one teacher's statement that "You have very little time to actually begin a new skill, work on a new skill." I noted that teachers taught a new concept in about 60% of the lessons observed. The teachers spent between 10 and 44 minutes introducing a new concept and practicing the new skill. Most lessons involving new information lasted under 25 minutes.

I noted behaviors during observations that aligned with comments made by teachers in the interview process. Teachers stated that they struggled to make significant gains in mathematics performance of basic skills students and find adequate time to teach new material and provide sufficient practice time. Researchers identified practice as an effective strategy to improve student mathematics performance in the areas of problem-solving, computation, number sense, and working memory. Teachers' responses to the interview questions indicated that teachers understood the need for guided and independent practice while observational data provided evidence to prove that teachers failed to provide both types of practice daily; therefore, the inability to provide guided and independent practice led to a gap in practice.

Summary of the Data Analysis

I derived the data analysis about the instruction of basic skills mathematic students from information collected when researching the literature and interviewing and

observing sixth grade mathematics teachers. When comparing the interview and observational results to the literature review discussion, I found that collectively teachers at the research site implemented the majority of suggested research-based best practices in self-efficacy, working memory, problem-solving, computation, and number sense to some degree. Table 5 outlines the degree to which I noted or the teachers discussed implementation of each best practice for each topic area investigated in the research questions. I interpreted consistent implementation to mean that teachers used the strategy in 75% of the 15 observations, some implementation to mean 30%-74% of the observations, limited implementation to mean fewer than 25% of the observations, and no implementation to mean that the strategy was not observed at all. I discovered that teachers collectively displayed strengths in addressing basic skills deficiencies by consistently implementing positive feedback, questioning techniques, reading comprehension strategies, modeling practices, and multiple modality methods. I identified the following areas of concern for basic skills mathematics instruction:

1. Collectively, teachers demonstrated limited implementation of alternative teaching approaches and student-centered learning tasks.
2. Collectively, teachers demonstrated limited implementation of having students create and use illustrations to improve computation and working memory deficits.
3. Collectively, teachers demonstrated concern in using and limited implementation of cooperative learning and peer-tutoring activities in all areas except problem-solving.

4. Teachers used real-life learning connections, but collectively, teachers demonstrated limited implementation of real-life learning tasks.
5. Collectively, teachers demonstrated limited implementation of daily practice in number sense concepts.
6. Collectively, teachers demonstrated limited implementation of basic facts practice.
7. Collectively, teachers demonstrated concern about and limited implementation of guided and independent practice of new concepts.

Data from interview responses indicated that teachers were aware of the value of using alternative teaching approaches, student-centered tasks, guided and independent practice, cooperative learning, and basic fact practice. In classroom observations, I expected to see teachers assigning problem-based tasks where students worked together and used a variety of resources to discover mathematical processes needed to reach mathematical solutions. Depending on the concept, I also expected to see teachers providing explicit instruction, followed by guided and independent practice. The teachers, however, discussed challenges that prevented the use of the strategies. Teachers identified lack of time, large class sizes, and leveled classes as the major factors that prevented implementation of research-based practices. The teachers expressed that they struggled to meet the needs of the large amount of struggling learners placed in the lower level class that contain the basic skills students. The teachers also discussed the challenge of using student-centered learning when a large amount of students in lower level classes struggle with most mathematical topics. The teachers explained the

challenge of providing practice time on new concepts when the low-level students displayed large amount of gaps and needed consistent review of previous concepts.

Evidence of Quality

Quality measures in the project study were designed to prove that descriptions and data analysis represented the reality of sixth grade teachers' experiences in the study. Researchers must take measures to ensure credibility, dependability, and transferability. Researchers of a credible case study create an accurate in-depth picture of setting and participants (Lodico et al., 2010). I ensured credibility by using multiple sources of data. The interview and observational data of five participants provided a broad representation of mathematics instruction of basic skills students, which enabled me to triangulate data to provide convincing evidence about how teachers instruct basic skills students. I also used member checking to establish credibility. Participants viewed transcript data to ensure that I presented information about perceptions of basic skills instruction accurately. Research experts served as external auditors who examined data collection protocols and results to ensure that I considered multiple angles (Lodico et al., 2010). Although I used linking numbers to organize data, I de-identified the data during the external auditing process. The external auditor clarified researcher bias by examining de-identified data and asking questions to make me examine assumptions and consider alternate viewpoints about instruction for basic skills students (Lodico et al., 2010).

I ensured transferability by spending adequate time at the middle school building trust and collecting data to obtain rich descriptions (Lodico et al., 2010). Case study researchers do not expect to establish generalizability due to the fact that only a few

participants are analyzed (Stake, 1995). Case study researchers, instead, can establish naturalistic generalizations where the reader relates to the experience of participants and adds his/her own story to the data (Stake, 1995). I provided rich descriptions of the sixth grade mathematics classroom to help the reader develop a degree of similarity between the research site and other sites so that readers can make naturalistic generalizations. Lodico et al. (2010) described the concept of dependability as arriving at the same results through subsequent studies. I created a detailed explanation of data collection and analysis processes to ensure dependability of results. The credibility, transferability, and dependability measures I took helped established a rigorous case study.

Discrepant Cases

During the data analysis process, I paid special attention to discrepant cases. Discrepant cases could have skewed data analysis results; therefore, I needed to investigate conflicting cases to determine how data informed the study, answered research questions, and related to the theory base about instruction for struggling mathematics students established in the literature review. I created a code for contrary information, included discrepant data in the interpretation of results, and provided an explanation for conflicts to provide authentic results (Lodico et al., 2010). The interview and observational data contained very little outlying data; however, I included disconfirming information as a code within each topic area under the research questions. I provided explanations based on teacher responses to justify discrepancies and blend information together to accurately paint a picture of basic skills mathematics instruction.

Conclusion

The project study provided information about instruction for sixth grade basic skills mathematics students by collecting data through interview and classroom observational techniques. I used the data collection process to uncover teachers' perceptions about how to instruct basic skills students. The observational process provided me with information about actual instructional habits of mathematics teachers when working with struggling students while interview data provided evidence about teachers' philosophies in teaching basic skills students. I aligned the data collection tools with themes that emerged from the literature review; therefore, interview questions and observational field notes were designed to focus on understanding instruction related to problem-solving, computation, number sense, working memory, and self-efficacy.

The project study design incorporated triangulation, member checking, and external auditing efforts as well as methods to collect thick descriptions and detailed procedures to ensure credibility, dependability, and transferability. Data analysis included a six-step process of collecting, preparing, reading, and coding data to create themes and descriptions. The goal of the study was to gain a better understanding of the phenomenon of mathematics instruction of basic skills students. The study findings indicated that teachers at the research site struggled to implement alternative teaching approaches, student-centered learning tasks, guided and independent practice, cooperative learning, and basic fact practice. Teachers identified lack of time, large class size, and leveled classes as the major factors that prevented implementation of research-

based practices. The findings from the data analysis assisted in the creation of the project.

Section 3 of the project study provides a detailed explanation of the project. The project is based on research findings related to improving instruction for basic skills students. The goal of the project is to inform school administrators and mathematics teachers of the results in the study and to provide recommendations for effective instruction for basic skills students. Section 3 provides a rationale for the project genre, a literature review to provide justifications for recommendations on improving mathematics instruction of basic skills students, details about implementation of the project, a policy analysis, and a summary of project implications. The results of the project study might help other educators learn about successful instructional strategies and understand instructional challenges other teachers face when working with struggling mathematics students.

Section 3: The Project

Introduction

The literature review from Section 1 indicated several best practices in instruction for basic skills mathematics students. Research suggestions included strategies such as implementing alternative teaching approaches, student-centered learning activities, real-life learning experiences, cooperative-learning activities, and daily opportunities for guided and independent practice. Data analysis findings indicated that although teachers at the middle school under study implemented many effective mathematical strategies, teachers struggled to implement the suggested strategies mentioned above. Teachers identified the district policy of tracking middle school students in mathematics as a barrier that prevents the use of the mentioned best practices.

Research findings were used to design a project that would help address obstacles teachers face when teaching basic skills students in leveled-mathematics classrooms. The project genre selected to address the issues in leveling students was a policy recommendation communicated through a position paper. The position paper included a description of the current district policy regarding leveled classes, a background on leveling issues, and recommendations for addressing the issues. Section 3 provides a description of the project including a summary of project goals, justification for selection of policy recommendation and a position paper, analysis of current literature relating to the theory of leveling students, descriptions of implementation plans and evaluation measures for the project, and a discussion of implications related to the project.

Description and Goals

The purpose of the policy recommendation was to address the issue that a portion of basic skills mathematics students at the school under study failed to reach the proficient level on the NJ ASK despite receiving intervention strategies. Teachers in the study identified the practice of leveling mathematics students as a barrier in meeting the needs of basic skills students; therefore, the policy recommendation provided recommendations to address issues surrounding track systems. The first goal of the project was to increase awareness about benefits and issues related to the policy of tracking students by presenting findings from current research and participant' perceptions. The second goal of the project was to increase knowledge about alternative student placement policies that were described by researchers. The third goal was to present recommendations based on research and data analysis findings to district administrators and teachers. The last goal was to improve the quality of basic skills students' classroom environment in an effort to increase performance on the NJ ASK.

Rationale

Researchers have the responsibility to report research results upon completion of a study. Practitioners rely on research results and recommendations when making educational decisions about curriculum, instruction, and assessment (Lingenfelter, 2011). When presenting a research study to the educational community, researchers typically report results of a research project by summarizing characteristics of the study, research findings, and conclusions that resulted from findings (Creswell, 2012). Researchers select the format and design of the presentation based on conclusions drawn from the

study and characteristics of the audience (Merriam, 2009). Based on consideration of the above factors, a policy recommendation communicated through a position paper was selected for the project study with the additional intent of submitting the position paper as manuscript for publication.

Project Genre Rationale

As a responsible researcher, I have a commitment to present the findings of my project study to the educational community. The problem addressed through the research study related to underachievement of mathematics basic skills students at a middle school in New Jersey. Teachers identified the practice of leveling students as a barrier to basic skills student achievement. Brownson, Chriqui, and Stamatakis (2009) defined policy as laws, regulations, judicial decrees, agency guidelines, and budget priorities. Decisions about classroom structure, such as how to organize students, are related to guidelines or regulations; therefore, researchers could communicate issues related to leveling students through the process of policy analysis.

The intended audience members for this project were stakeholders responsible for enacting mathematics policies in the district. The potential policy makers were board members, administrators, teachers, and parents of basic skills students at the school under study. I intended to use research findings to inform policy makers about issues surrounding mathematics track systems, especially for basic skills students, in an effort to recommend an alternative approach to ability-grouping students. Scotten (2011) explained that writers should use policy papers to convince policy makers to make a change in current policy practices. Because my project purpose was to recommend an

alternative policy for organizing students, a policy recommendation, or policy paper, was the appropriate project genre for the project.

The process of policy analysis involves defining the problem, setting goals, examining arguments, and analyzing implementation of a policy (American University, n.d.). A policy paper is a recommendation in response to a policy analysis, which includes an introduction to the problem, background about the current policy, analysis about issues surrounding the policy, description of alternative policies, and recommendations for solving policy issues (Scotten, 2011). A position paper was an appropriate format to communicate the research findings, policy analysis, and policy recommendations. The purpose of a position paper is to present a valid, informed, and feasible position about a problem based on an analysis of scholarly research and stakeholder perspectives (Thomas, Potter, & Allison, 2009). The sections of a position paper blend well with the purposes of a policy recommendation; therefore, a position paper was an acceptable format for the project study. The purposes and characteristics of policy analysis, policy recommendation, and position papers fit the intentions of the project study that were derived from the problem, literature review, and data analysis of the project study.

A policy recommendation was more appropriate for the research project than an evaluation report, a curriculum plan, or professional development plan. Leveling students for mathematics instruction is a policy for student organization, not a program outlining a list of activities for accomplishing goals; therefore, a program evaluation did not fit the data analysis results. Curriculum plans require districts to outline the content,

sequencing, and materials in a subject area. Professional development plans provide opportunities for teachers to build knowledge in content and instructional strategies. It is possible to improve basic skills mathematics performance by improving the mathematics curriculum presented to basic skills students or by enhancing teacher quality, but data analysis results of teacher perceptions and practices indicated a more pressing concern related to teaching a large class of struggling students due to the policy of leveling students. It seemed more plausible to address the issue that teachers viewed as the biggest challenge first. Once the district removes the barriers effecting instruction of basic skills mathematic students caused by the track system, the district can assess the effectiveness of other areas such as curriculum and teacher quality.

Content of the Project Rationale

The problem addressed by the project study was that a portion of basic skills students failed to reach the proficient level on the NJ ASK in mathematics. The purpose of the project study was to understand teachers' perceptions about mathematics instruction of basic skills students in an effort to uncover problematic areas. The interview and observation data analysis indicated that teachers struggled to implement the research-based best practices of student-centered, alternative, real-life, and cooperative activities due to the policy of tracking students for mathematics. Teachers explained that most of the basic skills students were placed in the lower level classes with special education students, which created a large class of struggling learners. Teachers indicated that it was hard to use best practices when so many students in the class struggled with most mathematics concepts and very few students displayed leadership abilities.

Most current research in leveling students indicated that track systems did not improve student performance for low-level students (Macqueen, 2013; Marks, 2013; Spielhagen, 2010). An analysis regarding the theory of ability grouping students for mathematics instruction provided evidence for benefits and consequences of a track system and recommendations for alternative ways to organize students. The position paper presented information outlining the current policy about tracking, a synthesis of current literature describing benefits and consequences of track and de-track systems, and recommendations for how to change the policy. Information in the position paper provided teachers with an alternative to overcrowded low-level classrooms. The change to a de-track system will decrease the number of struggling learners in one class and increase the number of mathematical leaders in low-level classrooms. Improvements to the classroom environment will provide teachers with opportunities to use best practices with the intention that basic skills student performance will improve as a result of the changes.

Review of the Literature

Research was obtained by using Walden University Library and Goggle Scholar search engines. Education from Sage, Education Research Complete, Eric, and psycINFO databases were searched to collect recent scholarly literature related to effects of leveling on student learning. Search terms included *leveled-classrooms*, *ability grouping*, *track systems*, *de-track systems*, *homogenous grouping*, *heterogeneous grouping*, *policy recommendation*, and *policy analysis*. I also searched the reference lists of articles read to identify additional related articles.

I first conducted a search using the search terms related to leveling as well as the terms *mathematics*, *intermediate school*, and *middle school* to collect data that best matched the setting of the school under study. The search using the terms *intermediate* and *middle school* produced a limited amount of articles; therefore, I extended the search to include *primary* and *secondary levels*, which resulted in 22 articles. I expanded the search beyond the subject of mathematics to include general studies not related to a specific content area in an attempt to enhance the data collection results. The search yielded 24 additional articles. During the search process, I eliminated articles that focused solely on special education, ELL, gifted and talented, ethnicity, or socioeconomic levels because these categories did not match the study population or school characteristics of the school under study. I felt confident that saturation was reached when database searches yielded no new authors or studies. My database search on *policy analysis*, *policy recommendation*, and *position papers* yielded 14 additional articles. In all, I read 60 articles to support the project study.

Research analysis indicated that teachers struggled to implement best mathematics practices and meet the needs of struggling students due to the school policy of leveling students. The review of literature was designed to review findings about the effectiveness of track and de-track systems in an effort to propose solutions to issues teachers encountered as a result of the track system in place. The findings of this project study supported a policy recommendation to implement a de-track policy for mathematics placement.

Project Genre

Policy analysis is the process of examining the implementation of a policy to identify problems inherent to the policy, detect causes of the problem, and propose recommendations to improve the policy (Scotten, 2011). Policy analyses and recommendations are communicated through position papers. The purpose of a position paper is to clarify issues and challenge practices in order to support an empirical point of view (Archbald, 2008; Craver & Ober, 2011; Thomas et al., 2009). The stages of a policy analysis include identifying the problem, researching about effectiveness of the policy and alternative policies, and evaluating the options to determine a recommendation to the problem (Scotten, 2011). The structure of a position paper includes introduction of the issue, background of the policy, evidence related to the policy options, and suggestions for policy changes (Craver & Ober, 2011).

Policy analysis and position papers are common in the educational world. Education practitioners, policy makers, and researchers are interested in improving student learning (Lingenfelter, 2011). The educational leaders rely on the academic arena to identify effective educational strategies (Lingenfelter, 2011). Researchers present best practices through research studies and policy analyses. There is growing concern that an implementation gap exists between researchers' recommendations and policy enactment (Brownson et al., 2009). Brownson et al. (2009) suggested that the gap is a result of conflicting values and competing sources that interfere with research recommendations outlined in position papers. Lingenfelter (2011) indicated that unrealistic expectations in research recommendations, generalization of recommendations to different settings, and

complexity and unpredictability of human behavior are causes of the implementation gap between scholar and practitioner. To overcome the implementation gap, Lingenfelter suggested that policy writers acknowledge the complexity of the situation and avoid recommendations with simple interventions. Brownson et al. recommended building stronger empirical evidence by using a combination of quantitative and qualitative data when presenting policy recommendation. The recommendation to acknowledge complexity in educational issues influenced the creation of the recommendations in the position paper for the project study.

The search on policy analysis did not yield position papers specific to track system policies but did include several papers addressing other educational issues. In my literature analysis of position papers, I found two themes related to catalysts that prompt policy analysis and recommendation. Researchers were motivated to evoke changes in policies that caused greater inequality to marginalized populations. One example was a position paper written to provide recommendations to the Council for Children with Behavioral Disorders for improving the federal policy on regulating disproportionality in schools for special education students (Skiba, 2012). The structure of the position paper included a review of extent, status, and causes of disproportionality, review of history and issues involved in the enforcement of the current policy, and recommendations for improving the federal policy. The position paper recommended several changes to the policy. Two specific recommendations were of interest to me. The first recommendation suggested that schools should provide teacher training in disproportionality and common ways disproportionality was displayed in schools. The recommendation indicated the

importance of including teacher training when instituting new policies. The second recommendation proposed that schools develop criteria for measuring disproportionality. The significant aspect of the suggestion was that the author provided two ways for the school district to implement the recommendation, which supported Archbald (2008) and Lingenfelter's (2011) suggestion to provide multiple options for addressing the problem. The position paper provided an example of how to develop a position to solve inequality issues in education. The teachers in the project study identified that leveled classrooms prohibit teachers from implementing best practices in mathematics, which may create an inequality in educational experiences for basic skills students. Based on the analysis of the policy paper on disproportionality, I deemed that a policy paper was appropriate to address the inequality issue of leveling students.

A second example of the inequality focus was a position paper written to make recommendations about seclusion practices of students with behavior disorders (Peterson, Albrecht, & Johnson, 2009). The position paper outlined issues with secluding students and recommendations to improve the policy. The recommendations included creating a written document outlining the seclusion policy, making the policy known to parents and staff, and including staff training in the seclusion policy. The staff training recommendation was in line with Skiba's (2012) recommendation to include training, which further highlighted the importance of training in new policies. The position paper structure was similar to Skiba's in that it included an introduction to the problem, a declaration of principles, and recommendations regarding the use of seclusion in the school setting. Scotten (2011) suggested that researchers write concise position papers

that are clear and simple. The position paper written by Peterson et al. (2009) incorporated format characteristics that made the paper easier to read than other position papers. The author used the subheading definition of seclusion, purpose of seclusion, problem with seclusion, and what research says about seclusion. The subtopics used simpler words. The simplicity of Peterson et al.'s language influenced the organization of the project study's position paper.

The second theme found across the position papers related to student performance. A case study conducted by Culver (2010) to determine how discussions about educational equality affect policy decisions indicated that assessment of student outcomes often drove policy change. Culver suggested that assessment data has the potential to provide relevant information about the effectiveness of student learning. An example of performance driven policy analysis was a position paper written to address underachievement of low socioeconomic, minority, and low-achieving students (Peske & Haycock, 2006). The researcher investigated the connection between low-achievement of marginalized groups and high quality teaching in an effort to present the position that marginalized students underachieve due to the policy of assigning high quality teachers to top performing groups. The researcher suggested that schools change teacher placement practice by placing high-quality teachers with low-attaining students. The content presented in the position paper relating teacher quality to underachievement of marginalized groups mirrored the project study problem of underachievement for basic skills students; therefore, the paper was used as a model.

Peske and Haycock's (2006) position paper contained the required characteristics of policy recommendations; however, the paper included two additional features. The first feature was a summary of the federal policy relating to the teacher quality issue. The researcher summarized the No Child Left Behind Law requiring schools to provide students with fair access to quality. The practice of summarizing federal law gave credence to the evidence supporting the author's point of view. The researcher also included multiple options, which supported Archbald (2008) and Lingenfelter's (2011) position about the complexity of educational issues. The researcher commented that the inclusion of a range of strategies was provided in an effort to improve generalization of the recommendations. The researcher suggested that schools over-haul hiring practice to increase the amount of high-quality teachers working with low-attaining students. The researcher provided a range of ways to implement the recommendation including giving principals more authority in hiring decisions, scaling back on seniority favoritism, and creating a drafting strategy where the lowest performing schools receive first pick from the pool of teachers. The project study problem was defined as underachievement of basic skills students on performance assessments, which aligned with the concept of the position paper on teacher quality because in both examples student assessment drove the policy change. The position paper provided another example of how to build a point of view about an educational issue through the development of a position paper.

The search on policy analysis and position papers provided justification for selecting the genre for the project and examples of guidelines to follow when developing the project. The investigation regarding definition and use of policy analysis and position

papers indicated that the purpose of the project aligned with the purpose of a policy analysis. Teachers identified track classes as a barrier to student learning; therefore, the purpose of the project was to analyze the effectiveness of the track policy in an effort to recommend policy changes. The search on policy analysis also indicated that schools rely on research findings to guide the policy decision-making process. The analysis of current educational position papers indicated that inequality and student performance issues were major factors driving policy change. Policy analysis was the appropriate genre for the project because the problem of underachievement of basic skills students was an inequality and student performance issue. The analysis of educational position papers also provided key features that build strong points of view. To improve the strength of the project study position paper, I followed the standard format, presented concise information, included a connection to federal policy, and proposed recommendations for teacher training.

Research Support of Project Content

Teacher participants in the project study reported that leveled-classroom environments provided barriers when teaching basic skills students. Teachers perceived that classes were too large and contained many struggling learners, which prevented teachers from meeting students' individual needs. Teachers also discussed an inability to use student-centered strategies in low-level classes due to the fact that students at this level did not possess the characteristics needed to be successful in a student-centered environment. Teachers explained that students did not have a strong mastery of mathematics concepts, which affected students' ability to peer tutor. Teachers also

expressed concerns about students' ability to work independently during student-center activities. The last area of concern for teachers related to reteaching. Teachers discussed the issue that at least half of each class period was spent reviewing homework, which prevented teachers from dedicating the appropriate amount of time to teaching a new concept and providing guided and independent practice. Observational data confirmed that teachers did not implement student-centered, collaborative activities consistently and spent a large portion of class time reviewing homework.

A review of current literature regarding tracked systems provided insights into challenges teachers encountered in low-level mathematics classroom. During the literature analysis, I focused on analyzing descriptions, benefits, and issues associated with track systems, benefits and consequences of alternative student placement methods, and research-based suggestions for student placement. Focus topics for the literature review aligned with a policy recommendation and position paper, which was the project study genre and format. The literature findings indicated more consequences than benefits to track systems, and researchers suggested that schools should avoid ability-grouping students

Description of track systems. The literature review produced information about variations, frequency, and factors used in track systems. Current research studies used several terms when discussing leveled-classrooms. Chmielewski, Dumont, and Trautwein (2013) described tracking as a system that sorts students into homogeneous groups to help teachers to better meet needs of students. Other countries used the terms *streaming*, *ability grouping*, *setting*, *homogeneous grouping*, and *regrouping* to describe

practices of sorting students into different courses, study programs, or schools (Chmielewski et al., 2013). Researchers suggested that de-tracking was the alternative to track systems (Allensworth, Nomi, Montgomery, & Lee, 2009). De-tracking refers to the system designed to dismantle the processes used to sort students based on ability (LaPrade, 2011). Researchers also used the terms *mixed-ability* and *heterogeneous groupings* to represent a non-sorted environment. Different school organizations used different variations and terms to describe grouping practices, but the concept behind tracking related to sorting students based on ability or the concept behind de-tracking related to using mixed-ability classrooms.

The theory of tracking emerged in the middle of the 20th century in response to an influx of immigrant children in American schools (LaPrade, 2011). Teachers struggled to meet needs of diverse populations so educational leaders responded by enacting a track system (LaPrade, 2011). Early stages of tracking sorted students into tracks such as vocational, general, and academic in order to prepare students for potential careers (Allensworth et al., 2009; LaPrade, 2011). The theory developed out of the societal idea that Americans were “separate but equal” (LaPrade, 2011) and from the social efficiency theory that schools were obligated to prepare students for their place in society (Allensworth et al., 2009). The tracking theory has evolved over time in response to demands for equity. Today, schools track students into advanced, regular, or basic levels in subject areas based on performance. The premise of the practice is to separate students by ability to permit teachers to tailor instruction to the levels of students to maximize learning.

Even though current researchers recommended that schools not implement track systems, several current studies indicated that the school under study in the project study was not alone in tracking practices as tracking was still prevalent nationally and internationally. The results indicated that the majority of participants in the studies used some version of tracking (Harris, 2011; Hornby, Witte, & Mitchell, 2011; Kelly & Price, 2011). Other studies found that ability grouping practice increased as students progressed through from primary school to middle school (Forgasz, 2010; Huang, 2009). Research findings also indicated subject variations in ability-grouping practices (Harris, 2011; Kelly & Price, 2011). Researchers indicated that ability-grouping practices were most prevalent in mathematics (Dunne et al., 2011). A small percentage of participants in current research rejected the practice of tracking because of concerns about self-esteem and inequality issues (Ong & Dimmock, 2013; Sung, 2009). An analysis of current literature indicated that track systems were still a common practice throughout the world and were frequently used in mathematics.

Researchers found several factors that affected student placement in track systems. Kelly and Price (2011) determined that student placement was a complex process that involved consideration of multiple factors. Teachers interviewed in the project study commented that mathematics placement was based on student performance. Several studies indicated that schools used standardized and classroom test performance as well as teacher evaluation of performance to determine student groups (Dunne et al. 2011; Forgasz, 2010; Harris, 2011; Kelly & Price, 2011; Rickles, 2011). Researchers also determined that student grades factored into tracking students (Harris, 2011; Kelly &

Price; 2011; Rickles, 2011). Some school systems attempted to provide validity to the tracking process by basing placement on a combination of performance measures (Rickles, 2011).

Research findings indicated that other factors affected track system placement. Dunne et al. (2011) reported that school personnel considered pupil numbers, teacher availability, schedule logistics, and classroom accommodation when creating leveled classes. Schools also considered student factors such as behavior and role-model abilities in order to create healthy classroom climates (Dunne et al., 2011; Macqueen, 2012). Outside factors such as parent requests also influenced student placement (Harris, 2011; Macqueen, 2012). Research also indicated connections between course requirements and track-system placement. Kelly and Price's (2011) study indicated that secondary schools limited high-track enrollment by linking courses to programs of study and using pre-requisite requirements. The philosophy of student placement in a tracking system influenced schools to sort students by ability to provide a favorable environment for learning.

Researchers illuminated complex tracking practices that used diverse criteria to design tracked classes. Some of the factors such as class size, behavioral issues, and parent requests could create bias in tracking systems and make tracking practices less effective (Rothestein, 2009). Teachers in the project study identified class size and student behavior as barriers to learning in a track system. The project study position paper recommendation to de-track students provided a more equitable placement method.

Tracking benefits. The project study data analysis indicated that teachers agreed that leveled-classroom environments benefitted low-level students in that leveling allowed teachers to provide extra support needed to low-level learners. Current research identified some benefits to track systems in aligning with the participants' perceptions. Several researchers found that track systems provided characteristics that promoted a positive atmosphere for students. Macqueen (2012) investigated the effects of regrouping in Australian primary schools and found that regrouped students indicated having positive relationships with teachers, which resulted in a more positive attitude about school than in non-tracked classrooms. Students in the Venkat and Brown's (2009) comparative case study of two UK secondary schools also viewed school more positively in ability-grouped settings. Venkat and Brown suggested that realistic expectations set by teachers and extra help provided led to positive results.

Researchers also determined that students in general benefitted from the individualization of track systems (Chmielewski et al., 2013; Harris, 2011; Hornby et al., 2011). In a quantitative study conducted by Chmielewski et al. (2013) to compare how three different types of track systems affected mathematics self-concepts of students in 20 different countries, data indicated that track systems allowed teachers to cater to individual student' needs. Teachers in the Hornby et al. (2011) study indicated that between-class ability grouping helped schools to design classes based on matching teacher strengths to students' needs, which helped teachers meet students' needs.

Researchers also found benefits of tracking students for high-level students. Spielhagen's (2010) qualitative study that explored effects of limiting access to high-

level mathematics courses found positive benefits for top students. The American students in the study explained that providing Algebra in eighth grade to high-ability students improved preparation for high school and college work, expanded career choices, increased performance on the SAT, and increased honor's memberships and rewards. Teachers in Forgasz's (2010) qualitative study determined that track systems helped teachers to challenge top students, provided healthy competition among students, and developed stimulating mathematical conversations with students, which reduced boredom among high-attaining students.

A few researchers discovered that track systems improved high-attaining student performance on assessments (Koerselman, 2012; Matthews, Ritchotte, & McBee, 2013, Spielhagen, 2010). Koerselman (2012) conducted a longitudinal study to investigate effects of comprehensive school reform policy in the UK. Findings indicated that tracking policies resulted in an incentive effect for high-attaining students as students were driven to achieve high-test scores to earn a placement in upper tracks in secondary schools.

Current researchers also addressed benefits of track systems for low-attaining students. The teachers in Forgasz's (2010) study felt that tracking helped teachers to modify the pace of a lesson to meet the needs of low-attaining students. Teachers also commented that providing extra help and enrichment to low-level students improved confidence. Frenzel, Goetz, Pekrun, and Watt (2010) conducted a longitudinal study to analyze development of trajectories of mathematic interest for German students in middle school grades. Findings indicated that low-attaining students benefitted from a track

system because less demanding curriculum helped students to gain confidence. Students felt more positive about mathematical abilities when focus changed from being compared to all students to being compared to only low-attaining students. A few research studies also indicated that track systems led to improved performance at the primary grades (Venkat & Brown, 2009) or in smaller pullout environments (Dunne et al., 2011). Researchers and teachers from the project study agreed that track systems have the potential to challenge higher-level students, meet needs of low-level students, and build self-confidence levels. Observation data from the project study also indicated that track systems influenced the relationship between teachers and students. In one specific classroom, the teacher's approach in providing step-by-step guidance on a daily basis and to dignifying low-level students responses led to positive classroom experiences.

Track system issues. Teachers in the project study suggested that leveled classes did provide some benefits to students, but also agreed that creating a class with large numbers of struggling learners limited what teachers could accomplish when working with low-level students. Research findings also indicated several consequences of tracked systems. One consequence discussed in current literature related to student performance. Researchers demonstrated achievement gaps between low and high students in tracked systems. Interview results in Marks' (2014) study on educational triage indicated that lower-track sixth grade students made less gains (7 months growth) on standardized tests than higher-track students (1 year 4 months growth). Schillar, Schmidt, Muller, and Houang (2010) conducted a quantitative study to examine schools with disadvantaged groups in 100 high schools and found that lower-level tracks covered

less curriculum (0.78 of a year) than higher level tracks (1.15 of a year). The lower-level students steadily fell behind so by the end of 12th grade, lower level students learned 0.81 of a year less curriculum than other students.

Researchers on student achievement in track systems also revealed consequences for intelligence. Becker, Lüdtke, Trautwein, Köller, and Baumert (2012) investigated effects of tracking on psychometric intelligence for German students in middle and high school. Longitudinal data indicated that high-level students gained more intelligence (31%) over a four-year period than low-level students (23%). Results of the study indicated that environment affected intelligence, which challenged the theory of stable intelligence. A few teachers in the project study commented that basic skills students made little progress on standardized tests and observational data revealed that half of the low-level class performed below 70% on a unit assessment.

Research on track systems also identified consequences to student characteristics. Research indicated that ability grouping affected self-concept. Ireson and Hallam (2009) conducted a longitudinal study to determine mixed-ability estimate effects on self-concept for 11th through 9th grade students in England. Findings revealed that students in the most stratified courses displayed the least positive academic self-concept. Low and middle track students demonstrated less academic self-concept than high track students. Spielhagen's (2010) interview data indicated that tracking practices for eighth grade Algebra resulted in students developing perceptions about mathematic identity. High-track students described themselves as studious and involved while low-track students

described themselves as lacking study skills, preferring easier work, and displaying disruptive behavior in class.

Sui and Tse's (2012) quantitative study conducted to compare differences in mood, coping strategies, and self-esteem of tracked primary students in Hong Kong indicated that higher-leveled students displayed higher levels of self-esteem than low-level students (18.3 vs. 17.1). Students also reported using more emotion-oriented (14.3 vs. 13.3) and problem-orientated (9.3 vs. 8.6) coping strategies. Sui and Tse suggested that high academic performance built positive self-image, which enhanced the use of coping strategies and self-esteem. A few teachers in the study described basic skills students in the low-track as displaying low self-efficacy, a few expressed that self-efficacy levels depended on the student, and one teacher believed the low-track experience resulted in higher self-efficacy for basic skills students.

Marks (2014) conducted a case study to examine how lowest attaining year six students experienced educational triage. Teachers perceived that small group instruction in tracked systems resulted in an over-reliance on teachers for correct answers and prevented students from developing self-help skills. In Venkat and Brown's (2009) comparative case study, students in mixed-ability classrooms developed more independence as a result of the teacher not always being available to provide assistance while the majority of the students in ability-grouped classrooms developed a preference for teacher explanations and a reliance on the teacher. Teachers in the project study expressed concerns with the independence level in low-level classes, and observational

data confirmed that low-level students relied on teachers often when working on mathematics problems.

Research findings also indicated that behavioral differences appeared between tracks. A quantitative study conducted to determine the relationship between streaming and academic achievement in primary schools in the UK indicated that parents of low-track students were more likely to rate their child as having a behavior issue than high track parents (Hallam & Parsons, 2013). Kususanto, Ismail, and Jamil's (2010) results from a quantitative study conducted to measure perceptions of behavior as a predictor of self-esteem indicated that there was a relationship between behavior and low tracks. High school students in the study perceived teachers as spending a significant amount of class time controlling behavior and identified teachers who managed behavior as non-supportive. Low-level students explained that non-supportive teachers decreased levels of self-esteem. Current research findings indicated that tracked environments affected student independence levels, behavior, engagement, and self-esteem, which were also factors that appeared in teacher comments during interview sessions of the project study.

The final area in which track systems created consequences related to equity issues. Forgasz (2010) and Macqueen (2012) both discovered that tracked systems created a non-flexible environment for middle and high school students in Australia. The track system philosophy intended for grouping practices to be flexible; however, Forgasz and Macqueen both found that curriculums and pacing differed between the levels, which made it difficult for students in low tracks to advance to higher tracks. Van de Werfhorst and Mijs' (2010) comparative literature review found sizeable inequalities in tracked

systems across fourth through tenth grade. Comparative analysis indicated that more variance in learning appeared in differentiated secondary schools than comprehensive schools. Results indicated that negative effects of track systems in relationship to race, ethnicity, and family background increased with the length of tracking, which affected student attainment, dropout rate, and job outcomes.

Achievement expectations also created inequalities among high and low tracked students. Kelly and Carbonaro's (2012) quantitative longitudinal study indicated that 90% of middle and high school teachers surveyed expected high-track students to attend college but only 40% of teachers expected the same of low-track students. Kelly and Carbonaro suggested that bias in college expectation created a categorization effect based on track placement. Schillar et al.'s (2010) study on course access for disadvantaged middle and high school students indicated that teachers tend to decrease challenge level for low-level students based on low expectations of low-level students. Stevens and Vermeersch (2010) explored the nature of expectations held in streams in Belgium and found that teachers viewed high school students in lower classes negatively. Teachers described lower-track students as lacking ability, demonstrating negative attitudes, and displaying behavior problems. A few teachers in the project study also displayed lower expectations for low-level students. A few teachers mentioned that low-students were limited by deficiencies, indicated that low-level students were not mathematical leaders, and stated that low-level students were not capable of participating in mathematical conversations.

Current research indicated that teachers made inequitable pedagogical decisions as a result of track systems. The study conducted by Forgasz (2010) to analyze streaming effects in Australian schools indicated that 34 out of 38 high school teachers in the study modified instruction based on the level of students. Many of the modifications discussed in literature resulted in inequalities in mathematics experiences of low-level students. Forgasz found that teachers provided more challenge for high-functioning students than low-level students by increasing problem-solving, real-life, conceptual, exploratory, and open-ended tasks. Teachers in the study modified instruction for low-level students by focusing on practical math, breaking down language, finding relevant information, and tracking questions in word problems. The case study conducted by Marks (2014) and grounded theory study by Stevens and Vermeersch (2010) indicated that high school teachers incorporated repetition and reduced the level of challenge to modify instruction for low-level students. Stevens and Vermeersch also found that teachers reduced the amount of work, and Marks revealed that teachers used below grade level material and smaller numbers with low-level students. Teacher interview and observational data provided information to confirm that teachers in the study modified instruction by breaking down language, finding relevant information, tracking questions, and using repetition. Teachers guided students through solutions to word problems using this strategy.

Inequality in track systems further affected academic achievement of low-level students through textbook quality. El-Haj and Rubin's (2009) ethnographic data indicated that quality and cognitive challenge of instructional materials within textbooks

varied across middle and high school mathematics tracks. Low-level textbooks contained knowledge about basic simple recall of facts, routine procedures, and vocabulary recognition while the most advanced courses provided opportunities for students to engage in formulating problems, verifying results, and developing notation. Textbook bias limited low-level students access to mathematics curriculum. The middle school under study did use different mathematics textbooks for different levels; therefore, textbook bias may have been an issue affecting performance.

Research indicated inequalities related to teacher quality in track systems. Kalogrides, Loeb, and Bêteille (2012) conducted a quantitative study to understand the pattern of teacher student matching for Florida primary schools. Findings revealed that administrators tended to assign less experienced teachers or teachers with lower SAT scores to low-track classes while schools assigned teachers in leadership positions or teachers with degrees from competitive colleges to higher tracks. Kalogrides et al. suggested that even though teacher placement of a strong mathematical teacher for high students may have benefitted high-achieving students, inequality still existed for low students based on the finding that 10 years of teaching experience related to a $\frac{1}{3}$ increase in standard deviation in achievement.

Research also indicated inequalities in access to friendships in track systems. Flashman (2012) conducted a longitudinal study to understand the relationship between academic achievement and adolescent friendship choice for middle and high school students in the United States. Survey results indicated that high-achieving students tended to develop more friendships because low-attaining students and high-attaining

students were more likely to choose friends with high attainment. Flashman suggested that an inequality existed because high-level students ended up with more friendship options than low-level students.

Several research studies identified student demographics as an area of inequality. Findings indicated that many low performing students placed in low-tracks were marginalized groups. Montt's (2011) quantitative study findings indicated that low socioeconomic status was the biggest factor in achievement inequality for American high school students while El-Haj and Rubin's (2009) results highlighted the negative relationship between achievement and race, low SES, and ethnicity in middle and high school students. Since underachievement was a factor for low socioeconomic students and minorities, schools were more likely to place the marginalized groups into low-tracks. Survey data from studies conducted by Stevens and Vermeersch (2010) and Buchman and Park (2009) indicated that more high school students with a high SES status enrolled in higher-level classes than students with low SES levels. The pilot survey data from Hall's (2012) study demonstrated that students with immigrant parents enrolled in higher tracks less than other students, and the probability of dropping out of school increased when students had nonacademic parents.

Other demographic areas affected by inequalities in tracking practices were gender and age. A study conducted to investigate differences in the use of regrouping for fifth and sixth grade students indicated that low-level classes in the study contained more boys than girls, which suggested a gender gap (Macqueen, 2013). Hallam and Parsons (2013) determined that students born in autumn or winter represented 37% of primary

students in the top track while students born in spring and summer represented 35% of the low track. Results indicated an achievement gap between older and younger students. Despite the fact that multiple research findings supported the idea that socioeconomic inequalities existed in track systems, Hall (2012) did not find a gender impact on achievement, and Kelly and Price (2011) did not find relationships between demographic factors and tracking. Kelly and Price suggested that school response to past research about inequalities increased opportunity, which may have reduced inequalities.

Research studies also provided information to confirmed enrollment achievement gaps. Many findings indicated positive results in higher-level course enrollment that led to narrowed course enrollment gaps (Allensworth et al., 2009; Domina & Saldana, 2012; Schneider & Tieben, 2011). The findings, however, were not all positive. Results also indicated that middle-level students benefitted the most from new opportunities as adults (Schneider & Tieben, 2011) and that low-attaining students did not benefit from increased enrollment in Calculus as adults (Domina & Saldana, 2012). Domina and Saldana suggested that inequalities still existed because completion of Calculus increased the chances of attending college and pursuing high-status majors.

A final area affecting inequalities in track systems related to fixed-ability thinking by society, teachers, students, and parents. Marks (2013) conducted a qualitative study to analyze how teachers and students perceived ability of fourth through sixth grade students. Findings indicated that student' responses conveyed fixed-ability thinking in that students identified themselves by a track group and defined ability and mathematics identification based on the track group. Observation data in the Marks study also

indicated that student interaction reflected fixed-ability thinking. A high-attaining student played a mathematics game with a low-attaining student. In early stages of the game, the high-attaining student provided opportunities for the low-attaining student to succeed. At the end of the game, the high-attaining student gave the low-attaining student a challenging problem intentionally in order to win the game.

In El-Haj and Rubin's study (2009), middle and high school teachers expressed the notion that schools should classify more low-level students in order to determine diagnostic information and prescriptions for less-abled students. El-Haj and Rubin suggested that fixed-ability thinking of teachers in the study narrowed opportunities for students to learn by categorizing students based on the idea of innate, stable intelligence. Marks (2012) investigated discourse about mathematics ability, and interview data revealed that primary teachers attributed ability to IQ and genetics. Researchers suggested that fixed-ability thinking displayed by teachers caused a resistance to change from track system to de-tracked classrooms. Study findings indicated that labeling students as math enabled started at a young age and created an inequality in opportunities to learn as students progressed through school (Marks, 2012). Abraham (2008) responded to Hallam and Ireson's (2006) findings that students prefer certain grouping structures by stating that students could just simply conform to the dominant ideology of tracking found in schools as opposed to developing a preference. Abraham's analysis suggested that teacher's fixed-ability thinking negatively affected students' thinking about ability. The data analysis of the project study indicated that teachers at the middle

school were affected by fixed-ability thinking. A few teachers referenced the fact that basic skills students were limited by deficiencies and were working to their potential.

Researchers found that track systems benefitted high students in performance and opportunities. Ability grouping helped teachers to meet needs of low-level students and improved performance of low-attaining students in primary schools. Tracking did not increase middle and high school performance. Low-attaining students at intermediate and secondary levels made fewer gains in performance and intelligence, displayed lower self-concepts, coping, and independence levels, and track practices resulted in inequalities. Teacher interview and observation data also indicated that students in low tracks struggled with making performance gains, and developing high self-concepts, coping skills, and independence. The project study position paper proposed recommendations to address the tracking issues.

Benefits and consequences to alternative approaches. Researchers suggested that the alternative to track systems was to de-track students (LaPrade, 2011). Students receive the same educational experience regardless of ability in a de-tracked environment (LaPrade, 2011). The theory of de-tracking grew out of the Civil Rights Movement to create equality in America (El-Haj et al., 2009). The theory for de-tracking was based on the premise of raising the bar in expectations for students and providing support needed for students to succeed (LaPrade, 2011).

The researchers found benefits for students in de-track settings. The most common research finding in support of mixed-ability groupings related to accessibility of courses. Domina and Saldana (2012) conducted a longitudinal study to examine recent

trends in racial, class-based, and skills-based inequalities in high school mathematics course achievement in the United States. Findings indicated that standardized curriculum policies resulted in increased accessibility of mathematics courses and led to a 4.5 increase in Carnegie units in mathematics per student from 1982 to 2004. Results also indicated a modest improvement in test scores in that average standard deviation measures improved four points while the lower-track students scores jumped six points. Enrollment in trigonometry and higher courses rose from 19% in 1982 to 43% in 2004, and calculus enrollment increased from 5% to 14%. Hall (2012) conducted a quantitative pilot study to evaluate the effectiveness of tracking systems and found that when more years and number of courses were added to lower level high school tracks student attainment increased by 40%.

Mixed-ability school policies also provided benefits in achievement, equity, and meeting students' needs. Hornby et al. (2011) determined that mixed-ability classrooms provided opportunities for sixth grade teachers' to meet diverse needs and inspire low-level pupils with the influence of higher level students. Van de Werfhorst and Mijs (2010) conducted a comparative review of current literature from 24 countries to determine the impact of national education institutions on inequality and student achievement in fourth through 10th grades and discovered that standardization of curriculum resulted in strong positive correlations between race, ethnicity, and performance. Pekkarinen, Ussitalo, and Kerr (2013) conducted a longitudinal study to determine how institutional change from differentiation to a comprehensive system affected learning in Finland and found that standardization narrowed the achievement gap

between students of parents with a basic education and students of parents with a higher education by 2.2 points, which was statistically significant.

Venkat and Brown (2009) determined that students in mixed-ability settings demonstrated similar achievement as students in tracked settings for seventh grade students in England, and Allensworth et al. (2009) determined that universalizing college preparatory curriculum in high school did not effect the dropout rate for low-attaining students. Results from Venkat and Brown and Allensworth et al. indicated that mixed-ability policies did not negatively affect performance and attendance.

Researchers suggested that de-track policies could address the issues discussed by teachers during the interview process. A few teachers expressed frustration that basic skills students made small gains. Researchers found evidence that de-track systems improved learning for middle school students. Teachers were also frustrated with the high number of struggling learners in a class. De-track systems could eliminate this issue as students are mixed in de-track systems. Teachers expressed frustration that low-level classes lacked mathematical role models. Mixed-ability classrooms will infuse middle and high-level students in all classes increasing the number of mathematical leaders in each class. The mathematical leaders will help teachers to manage cooperative learning and student-centered learning activities. The de-track system will also reduce the inequality issues suggested by current literature. Mixed-ability classrooms will provide students with experiences using the same curriculum, which will reduce the curriculum and challenge gap discussed in literature.

The majority of consequences noted in current research related to track systems; however, a few studies indicated consequences resulting from de-tracked classrooms. A study conducted to analyze the impact of universalizing curriculum indicated that increasing access to college-level courses in high schools contributed to a 3% increase in failure rate for low students, 8.9% decrease in grades across different abilities, a drop in final GPA's for students except at the low-ability level, and no change in graduation rates (Allensworth et al., 2009). Allensworth et al. (2009) also found that universalizing curriculum resulted in an increased chance that the lowest students would not attend college by 2.8%. The policy resulted in little change in the amount of low-level students enrolling in course beyond geometry.

The Hall (2012) pilot study that measured the effectiveness of tracking indicated that expanding access to more academic courses affected dropout rates negatively. Findings indicated that an increase in academic content in lower tracks increased the dropout rate by 3.8%. Buchman and Park (2009) determined that undifferentiated school environments in Australia, Canada, New Zealand, Spain, and the United States caused students to develop unrealistic expectations about attending college. Survey results indicated that 60% of students planned to go to college but in reality only 33% actually attended. Students in Venkat and Brown's (2009) study involved in mixed-settings demonstrated negative outlooks about the environment. The seventh-ninth grade students described the class as boring and discussed frustration with behavioral problems of other students within the class.

The research indicated some teacher frustration with de-tracked systems. The teachers in the study conducted by El-Haj et al. (2009) expressed concern in a lack of resources to teach the varying levels, skills, and learning styles in a mixed-ability classroom. Teachers in the Harris (2011) study described frustration in balancing demands of high stakes testing with needs of students. Interview data from the school under study also indicated that teachers struggled to balance demands.

Current researchers on track systems highlighted several benefits and consequences for both track and de-tracked systems. The researchers agreed with teacher comments from the interview data that blending high- and low-level students benefitted students in regards to attainment and peer relations. Researchers also agreed with teacher comments in relationship to negative student characteristics displayed in low-level classes. Most educational approaches present benefits and consequences. Track systems presented more consequences than de-track systems. The benefits of de-tracking systems presented solutions to frustrations expressed by teachers during the interview process. The conclusions drawn from the literature review drove the recommendation to de-track classrooms at the middle school. Providing teachers with support and training in mixed-ability teaching will help reduce the potential consequences associated with de-track practices.

Suggestions. Many research results from the review of the literature indicated that high-performing students stand to gain more than low-performing students in track systems (Huang, 2009). Researchers suggested that school efforts to meet needs of a top-performing group should not disadvantage low-performing group (Forgasz, 2010;

Spielhagen, 2010). Meeting needs of any group should not disadvantage another group (Marks, 2014). Researchers from studies contained in the literature review made suggestions based on research findings about track and de-track systems, which could help when determining policy recommendations.

Several researchers found that curriculum disparities caused by track systems affected low-achieving students negatively (Becker et al., 2012; Forgasz, 2010; Schillar et al., 2010; Spielhagen, 2010; Sung, 2009). Spielhagen (2010) suggested that schools create policies that open access to all mathematics courses for students including low-attaining students. Sung (2009) stated that schools need a curriculum that implements a more democratic, diverse delivery of curriculum as opposed to a diversified curriculum. Becker et al. (2012) recommended that schools develop more demanding high-quality content for low-attaining students. The last curriculum suggestion found in the literature review related to textbook quality. Schillar et al. (2010) proposed that schools institute a proactive textbook selection process to ensure that textbooks incorporate high expectations in quantity and challenge for all students. Schillar et al. also made the suggestions that schools need to provide supplemental materials and resources to fill textbook gaps in meeting students' needs. The middle school under study used different textbooks for the different levels, which created inequality issues. The recommendations in the position paper suggested that schools address the textbook issue.

Researchers also made instructional suggestions to overcome the negative impact of tracking students. Most of the researchers found negative results when evaluating the effectiveness of track systems so researchers suggested instructional strategies to apply in

de-tracked classrooms. Allensworth et al. (2009) noted that de-tracking requires instructional change and suggested that educators focus on instructional quality when implementing a mixed-ability atmosphere. A few researchers recommended that teachers in a mixed-ability classroom incorporate cooperative learning strategies because students from the studies benefitted from the peer tutoring, motivation, and role modeling provided by the high-ability students (Macqueen, 2013; Sung, 2009). LaPrade (2011) proposed that teachers develop a student-centered, collaborative environment that builds teacher and student academic and social skills when implementing mixed-ability classrooms. Another instructional suggestion related to differentiated instruction. El-Haj et al. (2009) explained that teachers often confuse the intent of differentiating instruction by assuming that the practice meant that teachers had to develop separate lessons to meet needs of individual children. El-Haj et al. suggested that teachers provide multiple entry points for students to grasp concepts and demonstrate what they know about a concept, which was the real intent of differentiated instruction. El-Haj et al. also suggested that teachers use participatory activities that allow students to connect learning to the world and develop a deep understanding of the concept. The final instructional suggestion related to teacher quality. Macqueen (2013) recommended that schools provide professional development opportunities for teachers to develop a strong understanding of equity groupings and differentiated instruction.

Allensworth et al. (2009), Macqueen (2012), and El-Haj et al. (2009) suggested that teachers focus on instructional quality to ensure success in a de-track classroom. Researchers recommended that teachers use cooperative learning, participatory activities,

and student-centered tasks in mixed-ability classrooms. Researchers also promoted the idea that teachers in mixed-ability classrooms include lessons to develop social skills. Teachers in the project study expressed frustration that low-level environments prevented the use of the above strategies due to students' poor social abilities. The de-track environment will provide the conditions to allow teachers to implement the best practices. The position paper included recommendations related to best practices.

Several researchers discussed the deeply held attitudes about ability that led to track school policies (Bleyaert, 2011; El-Haj et al., 2009; Harris, 2011; Marks, 2013). Researchers made suggestions related to addressing the fixed-ability thinking. Morrison (2009) conducted a case study to understand experiences of a school system in Thailand as the school implemented a new definition of teaching and learning. Morrison recommended that schools develop and communicate a vision of equity, allow analysis and discourse about the vision, and prepare for tension and resistance when challenging paradigms of learning theories. Macqueen (2013) proposed that educational institutions develop strong school planning processes to overcome inequalities in education. Several researchers suggested that school planning process include opportunities for teachers to participate in collaborative discourse about inequalities to challenge assumptions and question theories (Bleyaert, 2011; El-Haj et al., 2009; Harris, 2011; Marks, 2013). Bleyaert (2011) proposed that school planning process include equity audits to evaluate policies and help schools to address achievement gaps and reduce educational inequalities. The final suggestion made in relation to fixed-ability thinking related to standards. El-Haj et al. (2009) noted that creators of standards selected standards in a

biased way to include a narrowed range of knowledge deemed necessary based on economic influences. El-Haj et al. proposed that schools allow teachers to analyze and discuss standards in order to reconfigure curriculum, pedagogy, and assessment in a way that builds the knowledge deemed important in standards. Teachers at the school under study displayed signs of fixed-ability thinking, which could interfere with the success of the de-track policy; therefore, the position paper recommended that teachers engage in discourse about equity issues.

The final area of suggestions made by researchers related to teaching to the whole child by addressing academic, social, affective, and social aspects of learning. Venkat and Brown (2009) proposed that school personnel reduce the focus on test scores because the narrow focus resulted in a decreased level of enjoyment and independence for students in track systems. Chmielewski et al. (2013) and Kelly and Turner (2009) suggested that school personnel decrease the focus on competition and ranking and focus more on developing lessons that increase interest, enjoyment, and competence in a mixed-ability environment. Ireson and Hallam (2009) recommended that schools balance focus between raising attainment and developing affective and moral aspects of learning when determining how to sort students. A few teachers in the study and research findings suggested that students in the low-track had higher self-esteem as a result of being compared to students similar to them. The position paper addressed the issue by recommending teachers participant in professional development on mixed-ability teaching.

Based on an analysis of teacher perceptions surrounding underachievement of basic skills students and research on track and de-track systems, I recommended that the school change from a track system to a de-tracked system. De-track systems will provide teachers with the environment to incorporate best practices of cooperative learning, real-life learning, student-centered tasks, and guided and independent practices. The de-track system will mix students and infuse mathematical leaders into all classrooms allowing teachers to use peer tutoring and small group instruction. Inclusion of best practices will increase the opportunity for understanding and improve the chance of growth in performance for basic skills students. The recommendation to move to a de-track system included suggestions for providing teachers with professional development in mixed-ability teaching to counter the consequences to de-track systems presented in the literature.

Implementation

In the position paper, I summarized research findings and made recommendations for how the district should address issues surrounding underachievement of basic skills mathematics students (see Appendix H). The project was designed to address barriers teachers identified and I observed during the data collection process. The position paper outlined my informed decision that the middle school should change from a track to de-track policy when determining student placement into sixth grade mathematics classes. The de-track policy recommendation presented five areas the middle school should address in order to increase success of a transition to a de-track system; this section

describes the plan for implementing the project and includes descriptions of needed resources, potential barriers, roles and responsibilities, evaluation measures, and social change implications.

Potential Resources and Existing Supports

To implement the project suggestion to change to a de-track policy, the district will need to make a commitment to the policy. The district will need to invest time as well as financial and human resources to the commitment. The recommendations outlined in the position paper will require different commitments and supports. The board of education, superintendent, mathematics supervisor, and principal approved the project study. The approval indicated that administration supported the project and saw a need for improving performance of basic skills students; therefore, the administration is a potential resource and existing support for project implementation. Teachers are potential resources and provide additional avenues for existing support. Teachers expressed discontent in the current placement policy increasing the likelihood that teachers will support a change in policy.

Changing the policy from a track to a de-track system will require time as the mathematics supervisor, principal, and assistant principal will have to create a new organizational plan for placing mathematics students. The district will also need to create a formal document outlining the de-track policy and might need to present the change to the board of education and superintendent for approval. Administration will also need to present the change to the school community including the teachers and parents; therefore, the school will need to arrange meetings and create presentation materials.

The district personnel will also need to address the school vision to make sure the premises outlined in the vision align with a de-track philosophy. It might be possible that the school will need to adjust the vision. The administration will need to invest time to align and communicate the vision. As part of the vision process, administrators, teachers, and parents will need time to address previously held assumptions about student ability to reduce the influence of fixed-ability thinking. The mathematics supervisor and teachers will need to invest time in creating a unified curriculum that aligns with current standards and prepares all levels of students for success in high school, college, and adult life. The meetings needed to address the vision, fixed-ability thinking, and curriculum factors may require funding to provide release time for teachers to participate in the decision-making process.

The district personnel will also need to allocate funding for the change to a de-track system. It might be possible that the school will need to adopt or order new textbooks or supplemental materials. The district will also need to provide teachers with professional development opportunities in mixed-ability teaching and differentiated instruction. The district may need to use external organizations to provide teacher training, which will require funding. The district will also need to provide time for teachers to work collaboratively to design instructional lessons that implement the research-based mathematics strategies identified in the literature review in Section 1 and deemed necessary by teachers during the interview process. Collaborative meetings may require districts to provide teachers with release time, which will require funding.

Potential Barriers

Barriers to the process of de-tracking students for mathematics relate to the areas of resistance, resources, and support. The initial potential barrier is that administration will reject my project and suggestion to eliminate the policy to track students.

Administration may hold strong ideas in favor of tracking students or may have ulterior motives for implementing track systems that would cause the district to reject the proposal. A potential solution to the barrier is to prepare a strong position paper. Writing experts indicated that a prevailing factor in determining if a policy is accepted is how well the issue and argument are presented in the position paper (American University, n.d.). Lingenfelter (2011) suggested that effective policy recommendations are realistic and take into consideration the complexity of social situations.

A second potential barrier relates to resistance of teachers and parents. Although teachers expressed a need for change in dynamics of the low-level class structure, teachers may still possess fixed-ability thinking, which could affect implementation of a new policy. Some teachers may not support de-tracking top-level students as teachers only suggested de-tracking the bottom two tracks during the interview process. Parents of students in all levels may resist change out of fear for future consequences. Parents of low-level students may fear that students will not handle higher expectations in a mixed-ability class. Parents of middle-level students may fear that teachers in mixed-ability classes will address needs of high and low students but neglect middle students. Parents of high-ability students may be concerned that other students will hold higher students back. A potential solution to this potential barrier is to allow teachers and parents to

engage in discourse about inequality issues and fixed-ability thinking. The district can hold sessions where facts about performance are presented, and stakeholders can identify and address assumptions and limitations that cause inequality issues in performance. Another solution to address the barrier is to provide professional development in mixed-ability teaching.

A third potential barrier to success of the project relates to the area of limited resources. The district may not have the time and funding to support a change in policy. Districts make budget decisions well in advance based on school improvement plans and goals that span a specified time period. The district may have devoted available funds to providing support to meet goals of the current improvement plan. The school improvement plan may require employees to use meeting, planning, and in-service time to address goals in the school improvement plan leaving no available time for the school to address requirements of a de-track system. A potential solution to the barrier is to find professional development opportunities that do not require funding and to provide explanations indicating how the goals of a de-tracking system relate to the goals in the school's improvement plan.

A fourth potential barrier relates to staff relationships. Implementation of a new policy requires teachers to try something new, which takes trust, collaboration, and communication. Teachers may not feel comfortable taking risks and may fear repercussions if things do not go smoothly during implementation. Teachers and administrators may not have strong working relationships and may not communicate during the implementation process. A potential solution to the barrier is to develop

teacher buy-in by building enthusiasm about the potential benefits, acknowledging successes, building teacher capacity through professional development, accessing progress during implementation, and providing support for challenges teachers face.

Proposal for Implementation and Timetable

After gaining approval of my doctoral study and the position paper by Walden University, I will need to deliver the position paper to the mathematics supervisor in the district. After the supervisor reads the position paper, I will request a meeting with the supervisor to discuss findings of the project study and answer questions regarding information presented in the position paper. If the supervisor agrees to the proposed policy change, the supervisor will need to prepare a written document outlining the proposed change to a de-track system for sixth grade mathematics courses. In the policy document, the supervisor will need to develop a vision for student placement and explain how the vision aligns with the district's overall vision and school improvement plan. The supervisor will need to present the policy change to the superintendent and board of education for approval.

If the policy change is approved, the supervisor will need to present the policy change, vision, and goals to the principal, assistant principal, teachers, and parents. The supervisor will need to work with the principal and assistant principal to create a plan and timeline for the policy change implementation. The plan will need to identify the financial and human resources required to implement the plan. The proposed plan will need approval from the board of education.

The recommendation to move to a de-track system includes the process of a pilot study. The school should conduct a pilot to assess the effectiveness of the de-track system in meeting the needs of teachers, basic skills students, and others students and improving student performance on the NJ ASK. The pilot will need to last one year based on the nature of the policy. Changing student placement mid-year could cause major issues in scheduling and curriculum coverage. The principal and supervisor will determine which teachers and students will participate in the pilot study. Pilot teachers will receive professional development in mixed-ability teaching, culturally responsive classrooms, and differentiated instruction prior to and during the pilot process. Administration will evaluate the effectiveness of the de-track system pilot by using quantitative and qualitative measures. The district will use summative measures by comparing students NJ ASK mathematics scores prior to the pilot to the scores obtained after the pilot. The district will also use formative measures by using the quarterly LinkIt Benchmark Assessment scores to monitor progress during the pilot. Finally, the district will use qualitative measures by administering teacher surveys to assess perceptions about the effectiveness of the de-track system in addressing issues identified by teachers during the interview process.

If the findings from the pilot study indicate that the de-tracking policy is beneficial, the school will implement the de-track system universally in the sixth grade mathematics program. The process of implementation will follow the same plan as procedures outlined in the pilot phase with the exception of creating a universal alignment between the standards, curriculum, and textbook for all levels of students. The

alignment process is too complex, time consuming, and costly to implement during the pilot stage. If the district deems the de-track system beneficial in improving student performance, the mathematics department, which includes the supervisor and teachers, will work together to create alignment prior to full implementation of the de-track system.

The school will implement the pilot study in year one. If the pilot study proves beneficial, the school will de-track all classrooms under the conditions of the pilot study for year two. The administration will hold a meeting to educate parents regarding the change in policy prior to full implementation. During year two, the mathematics department will participate in mixed-ability classroom, culturally proficient schools, and differentiated instruction professional development and will conduct the curriculum, standards, and textbook alignment. The school will continue to evaluate effectiveness of the de-track system using the measures from the pilot study. During year three, the district will continue with the implementation procedures outlined in year two and will implement the new curricular changes designed during year two. The school will continue to evaluate effectiveness of the new policy using the evaluation measures and will modify the policy based on data for at least three years.

Roles and Responsibilities of Students and Others

I am responsible for writing and delivering the position paper to the mathematics supervisor. I will also offer my assistance during planning and implementation phases of the new policy. The mathematics supervisor is responsible for accepting suggestions outlined in the position paper and for presenting the new policy to the principal and

assistant principal for approval. The mathematics supervisor is also responsible for presenting the new policy to the board of education for approval and explaining the new policy to teachers and parents.

Administrators in the district are responsible for creating a plan and timeline for implementing the new de-track system and for overseeing the implementation of the pilot and full implementation phases. Administrators will need to arrange professional development opportunities and planning meetings, provide resources and support for teachers during implementation, and monitor the evaluation process. Teachers are responsible for implementing the de-track system. Implementation includes attending informational meetings about the de-track system and professional development sessions. Teachers will need to engage in collaborative discourse to address assumptions and create culturally responsible classrooms. Teachers will also need to work with colleagues to create a culturally responsive curriculum and to design effective lessons for mixed-ability classrooms. Teachers are also responsible for completing the evaluation measures.

Project Evaluation

The goal of the project study was to improve mathematics performance for sixth grade basic skills students. The proposed purpose of de-tracking students related to providing a more manageable classroom environment for teachers and students in order to implement researched-based strategies and meet student' needs. The evaluation of the recommended de-track plan is best measured through outcome-based and goal-based approaches. To assess effectiveness of the de-track system in meeting the outcomes and goals, I recommended the use of qualitative and quantitative measures.

I suggested the use of formative and summative standardized assessment measures to determine how the new policy affects student performance. Summative data from the NJ ASK administered before and after implementation will assist the school in determining if the de-track classroom environment and new teaching strategies resulted in increased mathematics performance. Formative data from the quarterly LinkIt benchmark assessment will assist the school in determining how the de-track system affected student performance over time. The school can use the formative data to make adjustments to the policy in response to challenges encountered during the implementation of the de-track system and new instructional practices.

I suggested using qualitative data to increase the validity of the evaluation process. The data from a teacher questionnaire will indicate teachers' perceptions about effectiveness of the de-track policy in improving student performance and addressing the barriers of the previous track system. Questions on the survey will uncover teachers' perceptions about the ability to meet student' needs, use cooperative learning, implement real-life tasks, incorporate alternative designs, include student-centered activities, and provide guided and independent practice on a consistent basis in the de-track classroom. The survey will also contain questions to determine teachers' impressions about how the de-track environment affected student performance. The final section of the survey will contain questions to elicit responses about successes and challenges teachers faced in the de-track classroom. The school will use data from the questionnaire to modify implementation of the de-track system and new instructional strategies in an effort to increase the chance of success for the new policy. Appendix I is an example of the

teacher questionnaire; however, the district may want to create the questionnaire to suit the school's needs.

The goal of the project was to improve student performance of basic skills students. The school can develop an outcome-based smart goal to represent the desired growth in response to the de-track policy. One example would be: By the end of 2018, the school will improve performance of basic skills students by 10% in mathematics as measured by the NJ ASK. The school personnel can develop each of the recommendations outlined in the position paper into a measureable goal toward meeting the outcome-based goal. The school personnel can design goals related to the creation of a culturally responsive curriculum, implementation of researched-based mathematics strategies, developing teacher capacity, and designing a culturally responsive vision for mathematics placement. The district can use evaluation measures to monitor progress toward the performance outcome and goals and make adjustments to the new policy to ensure that progress is made toward the performance outcome and goals.

Key stakeholders of the project and evaluation process are administrators and teachers. Administrators will create the de-track policy performance outcome statements and goals as well as the implementation plan. Administrators will also design and administer the qualitative questionnaire. Teachers will administer the NJ ASK and LinkIt Benchmark Assessments and will complete the qualitative questionnaire. Students are stakeholders in the evaluation process in that they will complete the quantitative measures. The administrators and teachers will analyze the data collaboratively to

identify successes, illuminate problematic areas, and modify practices to ensure success.

Parents are stakeholders since parents are indirectly impacted by student performance.

The overall goal of the evaluation process is to determine effectiveness of the de-track system. To determine the effectiveness, the school personnel needs to decide if the de-track policy improved the classroom environment for low-level students, increased the use of research-based practices with low-level students, provided teachers with opportunities to meet needs of struggling students, and improved basic skills students' performance in mathematics on the NJ ASK. The use of quantitative data from NJ ASK and LinkIt results and qualitative data about teachers' perceptions regarding effectiveness of the de-track system should provide evidence needed to assess effectiveness of the new policy. The evaluation measures will also provide the school with an ongoing system for evaluating the success of the de-track policy as the school personnel can continue to use the measures after the initial phase of implementation to monitor how the de-track policy aligns with the transformational educational landscape.

Implications Including Social Change

Local Community

The project might benefit struggling mathematics students because the position paper will bring awareness to issues teachers at the middle school encountered when teaching in a track system. Basic skills students need exposure to effective mathematics instructional strategies to increase mathematics performance. The position paper will provide information about the performance consequences of track systems and

recommend alternative ways of organizing student mathematics placement that have proven performance results.

Teachers might benefit from the project because the suggested de-track policy provides recommendations to meet instructional needs of teachers. The de-track policy will reduce the amount of struggling learners in one class making the class more manageable for teachers. The de-track system also increases the amount of mathematics leaders in each classroom enabling teachers to implement effective practices such as student-centered and cooperative learning activities. Professional development opportunities will improve teacher knowledge about meeting students' needs. Students will benefit from the increased use of best practices.

Social change might take place as more teachers improve their instructional performance and more students increase their mathematics achievement. Mathematics is a gatekeeper to success in high school, college, and life (Carolan et al., 2009); therefore, enhancing basic skills student performance in mathematics increases student opportunity in life and narrows the inequality gap in education. Teacher accountability systems are based on student performance and teacher evaluation to determine effectiveness of teachers. Building teacher capacity to provide instruction to basic skills students has the potential to improve student and teacher performance and provide job security for teachers. The local school district might benefit from improved teacher performance and academic performance in mathematics because the district might make strides in meeting student growth objectives and avoid the designation of a focus school.

Far-Reaching

The project study has the potential to benefit other suburban districts. Other suburban districts may struggle to meet needs of struggling mathematics students. Districts may also experience the same pressure to meet performance goals. Other districts may use track systems to organize mathematics students at the middle school level. Research findings and information contained in the position paper may increase awareness about consequences of track systems on low-level student performance and potential benefits of implementing a de-track system. If other districts implement suggestions outlined in the position paper, struggling mathematics teachers and students may benefit from increases in productivity, self-efficacy, and performance. The possible result of a de-track classroom is contented citizens who have potential to live healthier lives. The possible overall benefit of the project is that producing productive mathematical citizens with positive affective qualities improves the climate of society and success of the United States.

Conclusion

Section 3 included an outline for the project. The problem of underachievement of basic skills students and challenges teachers face when working with struggling students in leveled-classrooms led to an analysis of current research in effectiveness of track systems. The majority of research findings indicated that track systems have a negative impact on student performance, friendships, affective traits, and inequality issues. Researchers suggested schools implement de-track systems, which indicated positive results in higher-level course taking, achievement, equity, and meeting students'

needs. Based on current research findings, I determined that the middle school under study needed to change the student placement policy from a track to de-track system. Section 3 describes information contained in the position paper to convince the school system to change the placement policy. The description identifies resources and support needed to implement the policy change, potential barriers to implementing the change, plans, timeline and responsibilities for implementation, and evaluation measures to assess the success of the policy. The end of section 3 discusses the possible implications of the project.

Section 4 includes a summary of my reflections regarding the project study. I discuss strengths and limitations of the project. The discussion includes additional recommendations for how to describe and address the underachievement of basic skills students. Section 4 also includes an analysis of what I learned about the process of scholarship, project development and evaluation, and leadership as a result of conducting the project study. The discussion also includes my reflections about what I learned about myself as a scholar, practitioner, and project developer. Section 4 ends with a reflection about the importance of the project study and suggestions for implications and future research as a result of the findings.

Section 4: Reflections and Conclusions

Introduction

The purpose of the project study was to examine teachers' perceptions about mathematics instruction of basic skills students in an effort to uncover problematic areas. The study was designed to address underachievement of basic skills students. Data analysis indicated that teachers struggled to implement student-centered strategies as a result of the district track policy for student placement. An analysis of current literature indicated that track systems negatively impacted performance and self-confidence levels for struggling mathematics students and led to inequalities in curriculum, demographics, and expectations. Researchers suggested de-tracking students in mathematics, which led to the decision to write a position paper to recommend a change in placement policy at the school under study.

The purpose of Section 4 is to reflect on the process of creating the project study. In my reflections, I discuss the project study's strengths and limitations in addressing the problem and suggest alternative ways to address the problem. I reflect on what I learned about scholarship, project development, leadership, and change through this study. I also discuss how the project has shaped my role as a scholar, practitioner, and project developer. The conclusion provides an overall analysis of my work and what I learned about implications, applications, and directions for addressing underachievement of basics skills students.

Project Strengths

The first strength of the project was the selection of the problem of underachievement that was addressed in the position paper. The project study was designed to address the persistent underachievement that existed for a population of students. Researchers found that mathematics is a gatekeeper to success for students as they move through life (Lubienski, 2007, p.55). Addressing the issue will help reduce inequality in opportunities that exists for the basic skills population.

A second strength in the position paper was that the argument included connections to state and federal regulations regarding student placement and contained qualitative and quantitative research findings. The position paper also presented teachers' perspectives about barriers encountered in track placement policies. Teachers provided an insiders' view of the reality of the leveled-classroom environment. The pieces of evidence used to build the argument in the position paper improved the validity for the suggestion to de-track students.

A third strength of the position paper was the nature of recommendations presented in the position paper. Lingenfelter (2011) suggested that the complex nature of educational issues means that educators need to design complex solutions. The process of de-tracking mathematics students was a complex process. The strength in my recommendations was that I developed a complex plan to move from a track to a de-track system that included a pilot study, curriculum alignment, teacher discourse, and professional development. The layered approach addressed various factors important to the success of implementing a new policy.

The final strength in the position paper was the scholarly nature of evidence provided to support the suggestion to de-track students. The evidence that presented benefits and consequences of track and de-track systems was a result of a thorough analysis of current literature. Databases were saturated and studies from multiple countries with a variety of methodologies were included. I included an extensive literature review to ensure that the position paper presented an accurate picture of the reality of track and de-track systems.

Project Limitations

Although a scholarly approach was used, the project contained a few limitations. The first limitation was that the position paper was designed to address a learning issue in a specific district. The narrow focus and data from a small sample limited generalization to other settings. A second limitation of the project was that the district might not have the resources or time to implement the complex suggestions outlined in the position paper. The recommendation to move to a de-track system required the district to invest time in creating a plan for de-tracking students, a vision for equity, evaluation measures, and professional development for teachers. The recommendation also required funding to support a new textbook adoption, professional development opportunities, and collaborative meetings. The district might have committed resources to other plans and priorities, which might prevent the district from adopting the recommendations of the position paper.

Recommendations for Remediation of Limitations

The limitation of generalizing results was addressed by providing a rich description about realities of track classrooms for the school under study so that other districts could determine how the findings might apply to other contexts. The position paper also presented findings that described effects of tracking students for multiple ages, culture, and demographic groups, which improved generalization of the project. Limitation of feasibility could be addressed by analyzing the school improvement plan to align goals of de-tracking students with goals embedded in the school improvement plan. The alignment might help the district to see the value of the de-track policy in meeting the school improvement plan goals.

Ways to Address the Problem Differently

The position paper was designed to address the problem that teachers at the school under study were unable to implement student-centered learning strategies due to limitations caused by the track policy in the district. Teachers discussed that the barrier was related to limited independence and lack of mathematics ability of low-level learners. Teachers might have presented a biased view of the problem in the low-level class. The problem might have been that teachers had fixed-ability thinking about low-level students, which affected the decision-making process about how to instruct these students. The problem that teachers were not implementing student-centered activities could have been addressed differently by researching student-centered learning to provide suggestions for how to implement the strategy with low-level students and by providing extensive, ongoing professional development on culturally responsible thinking and

student-centered learning. Ultimately, I am happy with my decision to suggest de-tracking students due to the wealth of research that suggested that track systems resulted in many negative effects on learning for low-level students.

Scholarship

Scholarship is the process of acquiring knowledge. The project study and creation of the position paper taught me a lot about how to effectively acquire knowledge in order to present a scholarly position. Conducting two literature views to address problems related to underachievement in mathematics and of track systems taught me about the importance of saturating the literature. I learned to use multiple databases and search terms in order to capture an extensive amount of peer-reviewed articles. I also learned about the importance of including articles from diverse perspectives and settings in order to capture multiple perspectives. In engaging in the saturation process, I learned how to present an accurate reality of the situation under study. The systematic process of saturating the current literature enabled me to gain knowledge about mathematics instruction of struggling students and effects of track and de-track systems. The scholarship I have gained as a result of my study will be valuable to my position as a mathematics teacher.

Part of the process of scholarship is to pass on knowledge acquired when engaging in the process. I have valuable information to apply in my own classroom, but I also have valuable information to pass onto other mathematics teachers and administrators. Knowledge I have gained about mathematics instruction has the potential to evoke change due to the scientific rigor of the scholarship process I engaged in during

the project study. The final lesson I learned during the journey to create a project study was that scholarship is a life-long process. Life changes and students change; therefore, education must change. The only way schools will effectively keep pace with the transforming world is to engage in the scholarship process.

Project Development and Evaluation

The biggest lesson I learned about project development and evaluation was that the process is most effectively executed when school communities' work together to analyze and develop projects related to educational issues. I struggled to develop a project to address the problems inherent in track classrooms because I was not used to working in isolation. My educational and professional experiences have taught me the importance of being part of a learning community to address issues of such magnitude as in underachievement, which is full of controversy, as was the case with ability grouping. As a teacher, I planned lessons, created assessments, analyzed student issues, and developed curriculum documents by working with a team of teachers. Through my experiences, I discovered that collaborative teaching improved creativity, provided multiple perspectives, revealed biased thinking, and improved instructional quality. Working with teachers, parents, and administrators of the school under study to develop the project and evaluation plan for improving student placement would have enhanced the quality of the recommendations embedded in the project. Although the experience of creating the position paper developed my ability to synthesis data and develop a scholarly recommendation for change, I decided that project development and evaluation should be done collaboratively. Collaborative decision-making would have also improved the

probability that the district would adopt the policy recommendation to de-track students in mathematics.

Leadership and Change

I am a different educator as a result of the project study journey. The process of identifying a local problem, analyzing literature, conducting a study, analyzing data, and creating a recommendation for change has made me more confident in my knowledge about mathematics instruction. School leadership and personnel have developed a stronger level of respect for me based on my increased confidence and knowledge. The doctoral journey to solve a local issue has improved my leadership ability. The process helped me to gain a better understanding of teachers' realities in instructing struggling learners; thus, increased my sensitivity to teachers' frustrations. During my doctorate coursework, I learned that I am responsible for using the knowledge I have gained to evoke change. As a result of the process, I am now an educational leader. I plan to present the findings from the project study summarized in the position paper to administrators and teachers at the school under study, but the work will not stop there. I have learned that educational issues are complex and do not have simple solutions. Although the recommendations presented in the position paper were scholarly, the recommendation to de-track students may not be the appropriate answer for the school due to unforeseen circumstances. Change happens through honest assessment, commitment, and collaboration. As an educational leader, I will use my project as a catalyst to start the process of honest reflection, discourse, and analysis about the educational experiences of basic skills mathematics students at the school under study. If

my recommendation is not adopted, I will work with the mathematics department to develop a viable plan to address the underachievement of basic skills students.

Analysis of Self as Scholar

When I hear the term scholar, I think of a person who is knowledgeable about important topics or issues. Reaching the level of scholar in the field of education is a difficult task because of the complexity of learning and unpredictability of human behavior. Students are diverse in cultural interests, background, family dynamics, and learning styles, which creates an extensive list of topics and issues for teachers to understand. The completion of the project required knowledge about mathematics instruction, problem-solving, computation, number sense, working memory, self-efficacy, best practices, track systems, de-track systems, policy analysis, and position papers in order to recommend a solution for improving performance of basic skills students. In the literature review process, I learned how much theories change over time. Tracking was a widely respected theory at a time when schools were experiencing increases in immigrant students, but the Civil Rights Movement put pressure on schools to present equality for all students, so de-track systems were implemented. The knowledge I have gained about education has made me realize that the educational landscape is transformational. As society evolves student' needs evolve, and what once was effective may no longer be beneficial. The lesson I value most through the process of creating a position paper to recommend a solution to the underachievement of basic skills students is that a scholar is not a person who knows everything about a topic, but a

person who understands that education is complex and transformational and invests in life-long learning to keep pace.

Analysis of Self as Practitioner

The doctoral journey to create a project that solved a problem and evoked change has made me a better practitioner. A practitioner is a professional who engages in the research-based decision-making process to evoke change in the local setting. As a teacher, I was reluctant to engage in a scholarly process to search for answers to issues in my classroom because I lacked research knowledge and time. I also had the mindset that there was a simple, single answer to educational issues, and I wanted a magic answer to solve the issues. Literature findings on mathematics instruction and track systems presented multiple and sometimes conflicting perspectives about effectiveness of educational strategies. The complexity surrounding the findings helped me realize that there are no simple answers to educational issues. The process has taught me to broaden my understanding of local school problems by using research and stakeholder' points of view to gain multiple perspectives about an issue. I now know how to conduct research and what is required to propose solutions. I will be a better practitioner because I will not be able to settle for less than a scholarly decision-making process.

Analysis of Self as Project Developer

Project development is preceded by a project study. When I think back to attending the doctoral residency where information was presented about the project study process, I am surprised at how far I have come in the process of project development. At the residency, I spent time creating a problem statement. I found the task very

overwhelming then because I was challenged by the idea of finding words to describe a problem in a scholarly way. The prospectus development was also challenging because I struggled to find evidence to build a rationale for the problem and methods for my research study. As hard as the first two steps were, the proposal and project development phases were the most difficult parts of the process. Conducting literature searches on mathematics instruction of basic skills students and track systems to build scholarly support for data collection and recommendations was what made the process so difficult. I found it difficult to reach saturation and synthesize findings into a cohesive review of literature and position paper.

Reflecting on the journey has allowed me to see how far I have come in project development. The journey was a slow evolution from knowing very little about the research process, to developing an approved proposal, conducting a scholarly study, and designing a position paper. I was challenged by each step in the process, but overcame the obstacles by analyzing other project studies and position papers, dissecting the guidelines and rubrics, and using resources to improve my understanding of the process. Expert knowledge and advice from my doctoral chairs and librarians enabled me to navigate the project development process successfully. I still have a lot to learn about the research process, but the idea of developing a problem statement, research study, and project to address a local problem no longer intimidates me.

The Project's Potential Impact on Social Change

The project has potential to impact social change on the local level for basic skills students. My work is important to students, teachers, and administrators at the school

under study. The project provides information about the negative impact of track systems and positive impact of de-track systems for students. The information has the potential to change the student placement policy that exists at the school under study. The de-track system has the potential to create an environment that is more conducive to using research-based practices such as student-centered learning. Increased exposure to research-based practices has the potential to improve basic skills students', as well as other students', mathematics performance and help students reach proficiency levels. Reaching proficiency levels on the NJ ASK has the potential to provide more opportunities for basic skills students, and improve evaluations and job security for teachers. The district has the potential to benefit from increased performance because the school can avoid the status of focus school. The project is important because the position paper has the potential to open up dialogue about the basic skills mathematics program, instructional practice, and biased thinking, which could evoke change in educational inequalities for the basic skills population.

From this research, I learned the importance of providing teachers with the opportunity to influence the decision-making process. The interview process gave teachers a platform to voice concerns about student progress. Teachers were able to share successes, frustrations, and challenges of instructing basic skills students. Teachers had key insider knowledge, which was significant in understanding underachievement. I learned that teachers were eager to share their experiences because teachers wanted to engage in discourse about educational issues. Teachers wanted to improve instruction in the classroom, but teachers at the school of study often worked in isolation. I learned that

teachers need time to collaborate, bounce ideas around, observe each other, and debate in order to grow professionally.

Implications, Applications, and Directions for Future Research

The project study helped me understand that educational issues, such as underachievement, are complex, and one study cannot describe the complete picture of the phenomenon. The case study to understand teachers' perceptions about instruction of basic skills students was just the beginning of uncovering complexities surrounding underachievement at the school under study. The study findings and position paper was intended to provoke more curiosity and questions about the phenomenon, which led to implications, application, and direction for future research.

The project study findings have implications for the field of education and the local district. The project study recommended a change in policy from a track to de-track system to create an environment that is conducive to student-centered learning. The recommendation included the suggestion to engage in a recursive evaluation process to assess the success of the de-track policy in increasing the use of student-centered learning and improving student performance. Future research studies could also help the school assess the effectiveness of de-track systems by conducting quantitative studies to measure the effectiveness and qualitative studies to uncover teacher and student perceptions about the successes and challenges in de-track classrooms.

The project study findings have application considerations for the local school district and field of education. The project recommendation was created in response to the problem of underachievement at the local level, so the recommendation was very

applicable to the school under study. Findings from the project study can spark more questions about underachievement and led to future research studies. The findings indicated that schools avoid tracking students, and researchers proposed that mathematics programs adopt a philosophy of de-tracking students. Research could conduct further studies on how to effectively implement de-track classrooms. The research questions could relate to areas such as: challenging high-level students, building self-esteem, meeting student' needs, building social skills, and filling gaps in mixed-ability classrooms.

I conducted a case study to understand teachers' perceptions about mathematics instruction for basic skills students. Research questions were designed to collecting data for a large array of mathematical topics. The topics were problem solving, computation, number sense, working memory, and self-efficacy. Researchers could conduct research to understand instruction of just one topic to provide a more in-depth understanding of issues surrounding that topic. Researchers could also focus future research on conducting a case study to understand basic skills students' perceptions about mathematics learning to get students' insights about what works and does not work in learning mathematics topics and why basic skills students struggle. Researchers could also conduct a study to understand parents' perceptions about the learning of basic skills students. The different perspectives could help develop a more rounded view of the phenomenon of underachievement at the school under study.

Conclusion

Section 4 provided a summary about my reflections on the project study process. I focused the reflection analysis process on understanding strengths, limitations, implications, and applications of project findings. I also focused on understanding how my knowledge of scholarship, project development, evaluation, leadership, and change grew through the development of the project study. A final analysis related to understanding how the project study impacted my growth as a scholar, practitioner, and project developer. The reflections helped to form principles to guide my future as an educator. The principles were as follows:

1. Educational issues are complex and require complex solutions.
2. Teachers should use a research-based decision making process to address student learning issues.
3. Teachers should research and propose solutions collaboratively.
4. Teachers should use scholarly research from diverse perspectives to collect data about a phenomenon.
5. Scholars are responsible for presenting the findings of a research study in an effort to evoke change.
6. Scholarship is a life-long process due to the nature of a transformational world.

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Appendix A: Letter of Cooperation from a Community Partner

[REDACTED]

February 4, 2014

Dear Christy DeFilippis,

Based on my review of your research proposal, I give permission for you to conduct the study entitled "Perceptions of Teachers on Instructing Remedial Mathematics Students." within the [REDACTED]. As part of this study, I authorize you to recruit sixth grade mathematics teachers, interview and observe the sixth grade teachers, conduct member-checking processes, and disseminate results at presentation meetings. Individuals' participation will be voluntary and at their own discretion.

We understand that our organization's responsibilities include: assisting Christy DeFilippis in the recruitment of sixth grade mathematics teachers, permitting Christy DeFilippis with access to the research site to conduct teacher interviews and observations, and providing Christy DeFilippis with access to a room to conduct information and dissemination of results meetings. We reserve the right to withdraw from the study at any time if our circumstances change.

I confirm that I am authorized to approve research in this setting.

I understand that the data collected will remain entirely confidential and may not be provided to anyone outside of the research team without permission from the Walden University IRB.

Sincerely,

[REDACTED]

Walden University policy on electronic signatures: An electronic signature is just as valid as a written signature as long as both parties have agreed to conduct the transaction electronically. Electronic signatures are regulated by the Uniform Electronic Transactions Act. Electronic signatures are only valid when the signer is either (a) the sender of the email, or (b) copied on the email containing the signed document. Legally an "electronic signature" can be the person's typed name, their email address, or any other identifying marker. Walden University staff verifies any electronic signatures that do not originate from a password-protected source (i.e., an email address officially on file with Walden)

Appendix B: Participant Invitation Letter

Dear _____,

My name is Christy DeFilippis. I am a doctorate student in the Education Department at Walden University. I am conducting a research study as part of the requirements of my degree in Curriculum, Instruction, and Assessment titled “Perceptions of Teachers on Instructing Remedial Mathematics Students.” I would like to invite you to participate in the study because you are a sixth grade teacher of basic skills students at **Pine Brook School**.

If you decide to participate, you will be asked to participate in 2 interviews to describe your instruction for basic skills students, allow the researcher to conduct three classroom observations to collect data on your instruction of basic skills students, and examine the data collected from the interviews observations to check for accuracy. The interviews and observations will take place at **Pine Brook School** or a mutually agreed upon time and place. The interviews should last about 45 minutes and the observations will be conducted for an entire class period.

Participation in the study is confidential and study data will be kept in a secure location. The results of the study may be published, but your identity will not be revealed because pseudonyms will be used. Participation is voluntary and you have the right to withdraw from the study at any time. You do not have to answer any questions that make you feel uncomfortable.

I will be happy to answer any questions you have about the study. I will be conducting an informational meeting on _____, which you are invited to attend. If you would like to ask questions prior to that time, you may contact me at christy.defilippis@waldenu.edu or 732-643-0046.

Thank you for your time and consideration. If after the informational meeting you decide to participate, you will complete the consent form and arrange interview and observation dates with me.

Sincerely,

Christy DeFilippis

Appendix C: Consent Form

You are invited to take part in a research study regarding teacher perceptions of mathematics instruction with sixth grade basic skills students. You were chosen for the study because you teach sixth grade basic skills students. This form is part of a process called “informed consent” to allow you to understand this study before deciding whether to take part.

A researcher named Christy DeFilippis, who is a doctoral student at Walden University, is conducting this study. You may already know the researcher as a former sixth grade mathematics teacher at [REDACTED], but this study is separate from that role.

Background Information:

The purpose of this study is to learn more about sixth grade teachers’ perceptions about their instruction of basic skills mathematics students.

Procedures:

If you agree to be in this study, you will be asked to:

- Participate in an initial and possible closing interview (audio recorded and 30-45 minutes each)
- Allow me to observe your mathematics instruction of basic skills students three times (50-60 minutes)
- Participate in checking the data to ensure that it has been recorded accurately (30 minutes to look over data)

Here are some sample questions:

- Describe your experiences in working with sixth grade basic skills mathematics students.
- Tell me about how sixth grade basic skills students perform on problem-solving assessment.
- Tell me about how sixth grade basic skills students perform on computation assessment.
- Tell me about how sixth grade basic skills students perform on number sense, which is an intuition about the relative magnitude of numbers, assessments.
- Tell me about your experiences with self-efficacy levels of basic skills mathematics students.
- How do you provide remediation for struggling basic skills mathematics students?

Voluntary Nature of the Study:

This study is voluntary. Everyone will respect your decision of whether or not you choose to be in the study. No one at the middle school site will treat you differently if you decide not to be in the study. If you decide to join the study now, you can still change your mind later. You may stop at any time.

Risks and Benefits of Being in the Study:

Gathering teacher perceptions on their instructional practice poses low risk level to participants’ welfare. However, a low level of stress may be developed by participants due to observation and interview experiences. Risks to participants associated with this study will be anticipated and minimized by making the data collection experience as comfortable and natural as possible. The

participants will be made aware that the study will maintain confidentiality and that they can withdraw from the study at any time if they so desire.

Anticipated benefits for participating in the study include an increase in teacher knowledge about best mathematics instruction of basic skills students from reading the literature review and final project. Another benefit of participation is improved instruction and performance of basic skills mathematics students due to increased teacher knowledge. Also society benefits through social change as improving instruction for and performance of basic skills mathematics students increases student success in life.

Payment:

No compensation will be given for participation.

Privacy:

Any information you provide will be kept confidential. The researcher will not use your personal information for any purposes outside of this research project. Also, the researcher will not include your name or anything else that could identify you in the study reports because pseudonyms will be used. Data will be kept secure by being stored in locked boxes or on a password secured computer used only by the researcher. Data will be kept for a period of at least 5 years, as required by the university.

Contacts and Questions:

You may ask any questions you have now. Or if you have questions later, you may contact the researcher via christy.defilippis@waldenu.edu or 732-643-0046. If you want to talk privately about your rights as a participant, you can call Dr. Leilani Endicott. She is the Walden University representative who can discuss this with you. Her phone number is 612-312-1210. Walden University's approval number for this study is 04-23-14-0052359 and it expires on **April 22, 2015**.

The researcher will give you a copy of this form to keep. Please review the materials and notify the researcher through email or face to face of your decision regarding participation in the study within one week of the information meeting.

Statement of Consent:

I have read the above information and I feel I understand the study well enough to make a decision about my involvement. By signing below, I understand that I am agreeing to the terms described above. If you choose to participate, please return this form within one week.

Printed Name of Participant

Date of consent

Participant's Signature

Researcher's Signature

Appendix D: Audiotape Release Form

“Perceptions of Teachers on Instructing Remedial Mathematics Students.”

Researcher: Christy DeFilippis

Phone: 732-643-0046

Email Address: christy.defilippis@waldenu.edu

Faculty Advisor: Dr. Lucy Pearson

I hereby give permission to Christy DeFilippis to audio record my responses during the interviews for this study, “Perceptions of Teachers on Instructing Remedial Mathematics Students.” I further understand that my anonymity will be protected with the use of a pseudonym in collecting the data and that neither my name nor any other identifying information will be associated with the audio recording or transcription of my recorded responses. The recorded material will only be used for research purposes and for the presentation of the research. As with all research consent, I may at any time withdraw permission for audiotaped material of me to be used in this research project.

I acknowledge that there is no compensation for allowing myself to be audio taped.

I am permitting the review and transcription of my recorded interview by the investigator.

The tape will be kept for approximately 2 months and will be securely stored in a locked box. No one other than the investigators will have access to the data. After the data is collected and transcriptions are made, the tapes will be destroyed.

Participant’s Signature: _____ Date: _____

Investigator’s Signature: _____ Date: _____

Please keep this sheet for your reference.

Appendix E: Interview Protocol

Interview Protocol Guide for teacher initial interviews

Interviewer's Name: Christy DeFilippis

Position: Teacher of BSI Students

Interview Date: _____ Interview Time: _____

Interview Locations: _____

Research Study Purpose

The purpose of the initial interview will be to understand teachers' perceptions about the mathematics instruction of sixth grade basic skills students. Sixth grade mathematics teachers at the middle school were chosen to participate in the study because the teachers interact with the basic skills mathematics students on a daily basis. Data about mathematics instruction will be collected through teacher interviews and classroom observations. Teacher confidentiality will be protected because teachers' names will not be used in the data or final project study report. The interview will take approximately 45 minutes. The study is voluntary and, even though the participants signed the consent form, participants may withdraw from the study at any point. A taped recording will be used to ensure that data is collected accurately.

Interview questions matched with research questions

1. How many years have you been teaching in total?
2. How many years have you been teaching middle school mathematics?
3. How many basic skills students do you instruction currently?
4. What educational degrees or certificates do you hold?
5. Tell me about how sixth grade basic skills students perform on problem-solving assessments.
6. Tell me about how sixth grade basic skills students perform on computational assessments.
7. Tell me about how sixth grade basic skills students perform on number sense, which is an intuition about the relative magnitude of numbers, assessments.

8. Tell me about your experiences with self-efficacy levels of basic skills mathematics students.
9. Describe your experiences with the working memory, which is the cognitive system responsible for sorting, processing, and storing information, of basic skills mathematics students.
10. What have you found to be successful in working with basic skills students?
11. How do you provide remediation for struggling basic skills mathematics students?
12. What else would you like to share about your experiences in working with basic skills mathematics students?

Appendix F: Closing Interview Protocol

Interview Protocol Guide for teacher closing interviews

Interviewer's Name: Christy DeFilippis

Position: Teacher of BSI Students

Interview Date: _____ Interview Time: _____

Interview Locations: _____

Research Study Purpose

The purpose of the closing interview will be to understand teachers' perceptions about the mathematics instruction of sixth grade basic skills students. The closing interview will be designed to dig deeper into the instructional decision making process of mathematics teachers and make connections between the initial interview and observational data. Sixth grade mathematics teachers at the middle school were chosen to participate in the study because the teachers interact with the basic skills mathematics students on a daily basis. Data about mathematics instruction will be collected through teacher interviews and classroom observations. Teacher confidentiality will be protected because teachers' names will not be used in the data or final project study report. The interview will take approximately 30 minutes. The study is voluntary and, even though the participants signed the consent form, participants may withdraw from the study at any point. A taped recorded will be used to ensure that data is collected accurately.

Interview questions matched with research questions

1. Describe what you think is the hardest aspect of mathematics instruction when dealing with sixth grade basic skills students.
2. Describe what you think you do well in your instruction for sixth grade basic skills mathematics students.
3. Describe procedures that you implement to overcome the challenges you encounter when designing and providing instruction for basic skills students.
4. Describe any procedures that you implement to overcome the challenges the basic skills students encounter, which makes your classroom and instruction more effective for sixth grade basic skills mathematics students.

Appendix G: Observational Field Notes Protocol

Danielson's Framework For Teaching Evaluation Instrument

Setting: _____
 Observer: Christy DeFilippis
 Role of Researcher: Non-participant Observer
 Time and Data: _____
 Length of Observation: _____

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The Framework for Teaching Evaluation Instrument, 2013 Edition, is available in PDF format from the Danielson Group website, www.danielsongroup.org. Anyone may download this file and use the print version in his or her own setting.

DOMAIN 2 • THE CLASSROOM ENVIRONMENT

2a CREATING AN ENVIRONMENT OF RESPECT AND RAPPORT

UNSATISFACTORY • LEVEL 1

Patterns of classroom interactions, both between teacher and students and among students, are mostly negative, inappropriate, or insensitive to students' ages, cultural backgrounds, and developmental levels. Student interactions are characterized by sarcasm, put-downs, or conflict. The teacher does not deal with disrespectful behavior.

BASIC • LEVEL 2

Patterns of classroom interactions, both between teacher and students and among students, are generally appropriate but may reflect occasional inconsistencies, favoritism, and disregard for students' ages, cultures, and developmental levels. Students rarely demonstrate disrespect for one another. The teacher attempts to respond to disrespectful behavior, with uneven results. The net result of the interactions is neutral, conveying neither warmth nor conflict.

CRITICAL ATTRIBUTES

- The teacher is disrespectful toward students or insensitive to students' ages, cultural backgrounds, and developmental levels.
- Students' body language indicates feelings of hurt, discomfort, or insecurity.
- The teacher displays no familiarity with, or caring about, individual students.
- The teacher disregards disrespectful interactions among students.

- The quality of interactions between teacher and students, or among students, is uneven, with occasional disrespect or insensitivity.
- The teacher attempts to respond to disrespectful behavior among students, with uneven results.
- The teacher attempts to make connections with individual students, but student reactions indicate that these attempts are not entirely successful.

POSSIBLE EXAMPLES

- *A student slumps in his chair following a comment by the teacher.*
- *Students roll their eyes at a classmate's idea; the teacher does not respond.*
- *Many students talk when the teacher and other students are talking; the teacher does not correct them.*
- *Some students refuse to work with other students.*
- *The teacher does not call students by their names.*
- *And others...*

- *Students attend passively to the teacher, but tend to talk, pass notes, etc. when other students are talking.*
- *A few students do not engage with others in the classroom, even when put together in small groups.*
- *Students applaud halfheartedly following a classmate's presentation to the class.*
- *The teacher says, "Don't talk that way to your classmates," but the student shrugs her shoulders.*
- *And others...*

PROFICIENT • LEVEL 3

Teacher-student interactions are friendly and demonstrate general caring and respect. Such interactions are appropriate to the ages, cultures, and developmental levels of the students. Interactions among students are generally polite and respectful, and students exhibit respect for the teacher. The teacher responds successfully to disrespectful behavior among students. The net result of the interactions is polite, respectful, and business-like, though students may be somewhat cautious about taking intellectual risks.

- Talk between the teacher and students and among students is uniformly respectful.
- The teacher successfully responds to disrespectful behavior among students.
- Students participate willingly, but may be somewhat hesitant to offer their ideas in front of classmates.
- The teacher makes general connections with individual students.
- Students exhibit respect for the teacher.

- *The teacher greets students by name as they enter the class or during the lesson.*
- *The teacher gets on the same level with students, kneeling, for instance, beside a student working at a desk.*
- *Students attend fully to what the teacher is saying.*
- *Students wait for classmates to finish speaking before beginning to talk.*
- *Students applaud politely following a classmate's presentation to the class.*
- *Students help each other and accept help from each other.*
- *The teacher and students use courtesies such as "please," "thank you," and "excuse me."*
- *The teacher says, "Don't talk that way to your classmates," and the insults stop.*
- *And others...*

DISTINGUISHED • LEVEL 4

Classroom interactions between the teacher and students and among students are highly respectful, reflecting genuine warmth, caring, and sensitivity to students as individuals. Students exhibit respect for the teacher and contribute to high levels of civility among all members of the class. The net result is an environment where all students feel valued and are comfortable taking intellectual risks.

- The teacher demonstrates knowledge and caring about individual students' lives beyond the class and school.
- There is no disrespectful behavior among students.
- When necessary, students respectfully correct one another.
- Students participate without fear of put-downs or ridicule from either the teacher or other students.
- The teacher respects and encourages students' efforts.

- *The teacher inquires about a student's soccer game last weekend (or extracurricular activities or hobbies).*
- *Students say "Shhh" to classmates who are talking while the teacher or another student is speaking.*
- *Students clap enthusiastically for one another's presentations for a job well done.*
- *The teacher says, "That's an interesting idea, Josh, but you're forgetting..."*
- *A student questions a classmate, "Didn't you mean _____?" and the classmate reflects and responds, "Oh, maybe you are right!"*
- *And others...*

2b

ESTABLISHING A CULTURE FOR LEARNING

UNSATISFACTORY • LEVEL 1

The classroom culture is characterized by a lack of teacher or student commitment to learning, and/or little or no investment of student energy in the task at hand. Hard work and the precise use of language are not expected or valued. Medium to low expectations for student achievement are the norm, with high expectations for learning reserved for only one or two students.

CRITICAL ATTRIBUTES

- The teacher conveys that there is little or no purpose for the work, or that the reasons for doing it are due to external factors.
- The teacher conveys to at least some students that the work is too challenging for them.
- Students exhibit little or no pride in their work.
- Students use language incorrectly; the teacher does not correct them.

POSSIBLE EXAMPLES

- *The teacher tells students that they're doing a lesson because it's in the book or is district-mandated.*
- *The teacher says to a student, "Why don't you try this easier problem?"*
- *Students turn in sloppy or incomplete work.*
- *Many students don't engage in an assigned task, and yet the teacher ignores their behavior.*
- *Students have not completed their homework; the teacher does not respond.*
- *And others...*

BASIC • LEVEL 2

The classroom culture is characterized by little commitment to learning by the teacher or students. The teacher appears to be only "going through the motions," and students indicate that they are interested in the completion of a task rather than the quality of the work. The teacher conveys that student success is the result of natural ability rather than hard work, and refers only in passing to the precise use of language. High expectations for learning are reserved for those students thought to have a natural aptitude for the subject.

- The teacher's energy for the work is neutral, neither indicating a high level of commitment nor ascribing the need to do the work to external forces.
- The teacher conveys high expectations for only some students.
- Students exhibit a limited commitment to complete the work on their own; many students indicate that they are looking for an "easy path."
- The teacher's primary concern appears to be to complete the task at hand.
- The teacher urges, but does not insist, that students use precise language.

- *The teacher says, "Let's get through this."*
- *The teacher says, "I think most of you will be able to do this."*
- *Students consult with one another to determine how to fill in a worksheet, without challenging one another's thinking.*
- *The teacher does not encourage students who are struggling.*
- *Only some students get right to work after an assignment is given or after entering the room.*
- *And others...*

PROFICIENT • LEVEL 3

The classroom culture is a place where learning is valued by all; high expectations for both learning and hard work are the norm for most students. Students understand their role as learners and consistently expend effort to learn. Classroom interactions support learning, hard work, and the precise use of language.

- The teacher communicates the importance of the content and the conviction that with hard work all students can master the material.
- The teacher demonstrates a high regard for students' abilities.
- The teacher conveys an expectation of high levels of student effort.
- Students expend good effort to complete work of high quality.
- The teacher insists on precise use of language by students.

- *The teacher says, "This is important; you'll need to speak grammatical English when you apply for a job."*
- *The teacher says, "This idea is really important! It's central to our understanding of history."*
- *The teacher says, "Let's work on this together; it's hard, but you all will be able to do it well."*
- *The teacher hands a paper back to a student, saying, "I know you can do a better job on this." The student accepts it without complaint.*
- *Students get to work right away when an assignment is given or after entering the room.*
- *And others...*

DISTINGUISHED • LEVEL 4

The classroom culture is a cognitively busy place, characterized by a shared belief in the importance of learning. The teacher conveys high expectations for learning for all students and insists on hard work; students assume responsibility for high quality by initiating improvements, making revisions, adding detail, and/or assisting peers in their precise use of language.

- The teacher communicates passion for the subject.
- The teacher conveys the satisfaction that accompanies a deep understanding of complex content.
- Students indicate through their questions and comments a desire to understand the content.
- Students assist their classmates in understanding the content.
- Students take initiative in improving the quality of their work.
- Students correct one another in their use of language.

- *The teacher says, "It's really fun to find the patterns for factoring polynomials."*
- *A student says, "I don't really understand why it's better to solve this problem that way."*
- *A student asks a classmate to explain a concept or procedure since he didn't quite follow the teacher's explanation.*
- *Students question one another on answers.*
- *A student asks the teacher for permission to redo a piece of work since she now sees how it could be strengthened.*
- *And others...*

2c

MANAGING CLASSROOM PROCEDURES

UNSATISFACTORY • LEVEL 1

Much instructional time is lost due to inefficient classroom routines and procedures. There is little or no evidence of the teacher's management of instructional groups and transitions and/or handling of materials and supplies effectively. There is little evidence that students know or follow established routines, or that volunteers and paraprofessionals have clearly defined tasks.

CRITICAL ATTRIBUTES

- Students not working with the teacher are not productively engaged.
- Transitions are disorganized, with much loss of instructional time.
- There do not appear to be any established procedures for distributing and collecting materials.
- A considerable amount of time is spent off task because of unclear procedures.
- Volunteers and paraprofessionals have no defined role and/or are idle much of the time.

POSSIBLE EXAMPLES

- *When moving into small groups, students ask questions about where they are supposed to go, whether they should take their chairs, etc.*
- *There are long lines for materials and supplies.*
- *Distributing or collecting supplies is time consuming.*
- *Students bump into one another when lining up or sharpening pencils.*
- *At the beginning of the lesson, roll-taking consumes much time and students are not working on anything.*
- *And others...*

BASIC • LEVEL 2

Some instructional time is lost due to partially effective classroom routines and procedures. The teacher's management of instructional groups and transitions, or handling of materials and supplies, or both, are inconsistent, leading to some disruption of learning. With regular guidance and prompting, students follow established routines, and volunteers and paraprofessionals perform their duties.

- Students not working directly with the teacher are only partially engaged.
- Procedures for transitions seem to have been established, but their operation is not smooth.
- There appear to be established routines for distribution and collection of materials, but students are confused about how to carry them out.
- Classroom routines function unevenly.
- Volunteers and paraprofessionals require frequent supervision.

- *Some students not working with the teacher are off task.*
- *Transition between large- and small-group activities requires five minutes but is accomplished.*
- *Students ask what they are to do when materials are being distributed or collected.*
- *Students ask clarifying questions about procedures.*
- *Taking attendance is not fully routinized; students are idle while the teacher fills out the attendance form.*
- *And others...*

PROFICIENT • LEVEL 3

There is little loss of instructional time due to effective classroom routines and procedures. The teacher's management of instructional groups and transitions, or handling of materials and supplies, or both, are consistently successful. With minimal guidance and prompting, students follow established classroom routines, and volunteers and paraprofessionals contribute to the class.

- Students are productively engaged during small-group or independent work.
- Transitions between large- and small-group activities are smooth.
- Routines for distribution and collection of materials and supplies work efficiently.
- Classroom routines function smoothly.
- Volunteers and paraprofessionals work with minimal supervision.

- *In small-group work, students have established roles; they listen to one another, summarizing different views, etc.*
- *Students move directly between large- and small-group activities.*
- *Students get started on an activity while the teacher takes attendance.*
- *The teacher has an established timing device, such as counting down, to signal students to return to their desks.*
- *The teacher has an established attention signal, such as raising a hand or dimming the lights.*
- *One member of each small group collects materials for the table.*
- *There is an established color-coded system indicating where materials should be stored.*
- *Cleanup at the end of a lesson is fast and efficient.*
- *And others...*

DISTINGUISHED • LEVEL 4

Instructional time is maximized due to efficient and seamless classroom routines and procedures. Students take initiative in the management of instructional groups and transitions, and/or the handling of materials and supplies. Routines are well understood and may be initiated by students. Volunteers and paraprofessionals make an independent contribution to the class.

- With minimal prompting by the teacher, students ensure that their time is used productively.
- Students take initiative in distributing and collecting materials efficiently.
- Students themselves ensure that transitions and other routines are accomplished smoothly.
- Volunteers and paraprofessionals take initiative in their work in the class.

- *Students redirect classmates in small groups not working directly with the teacher to be more efficient in their work.*
- *A student reminds classmates of the roles that they are to play within the group.*
- *A student redirects a classmate to the table he should be at following a transition.*
- *Students propose an improved attention signal.*
- *Students independently check themselves into class on the attendance board.*
- *And others...*

2d

MANAGING STUDENT BEHAVIOR

UNSATISFACTORY • LEVEL 1

There appear to be no established standards of conduct, or students challenge them. There is little or no teacher monitoring of student behavior, and response to students' misbehavior is repressive or disrespectful of student dignity.

CRITICAL ATTRIBUTES

- The classroom environment is chaotic, with no standards of conduct evident.
- The teacher does not monitor student behavior.
- Some students disrupt the classroom, without apparent teacher awareness or with an ineffective response.

POSSIBLE EXAMPLES

- *Students are talking among themselves, with no attempt by the teacher to silence them.*
- *An object flies through the air, apparently without the teacher's notice.*
- *Students are running around the room, resulting in chaos.*
- *Students use their phones and other electronic devices; the teacher doesn't attempt to stop them.*
- *And others...*

BASIC • LEVEL 2

Standards of conduct appear to have been established, but their implementation is inconsistent. The teacher tries, with uneven results, to monitor student behavior and respond to student misbehavior.

- The teacher attempts to maintain order in the classroom, referring to classroom rules, but with uneven success.
- The teacher attempts to keep track of student behavior, but with no apparent system.
- The teacher's response to student misbehavior is inconsistent: sometimes harsh, other times lenient.

- *Classroom rules are posted, but neither the teacher nor the students refer to them.*
- *The teacher repeatedly asks students to take their seats; some ignore her.*
- *To one student: "Where's your late pass? Go to the office." To another: "You don't have a late pass? Come in and take your seat; you've missed enough already."*
- *And others...*

PROFICIENT • LEVEL 3

Student behavior is generally appropriate. The teacher monitors student behavior against established standards of conduct. Teacher response to student misbehavior is consistent, proportionate, and respectful to students and is effective.

- Standards of conduct appear to have been established and implemented successfully.
- Overall, student behavior is generally appropriate.
- The teacher frequently monitors student behavior.
- The teacher's response to student misbehavior is effective.

- *Upon a nonverbal signal from the teacher, students correct their behavior.*
- *The teacher moves to every section of the classroom, keeping a close eye on student behavior.*
- *The teacher gives a student a "hard look," and the student stops talking to his neighbor.*
- *And others...*

DISTINGUISHED • LEVEL 4

Student behavior is entirely appropriate. Students take an active role in monitoring their own behavior and/or that of other students against standards of conduct. Teacher monitoring of student behavior is subtle and preventive. The teacher's response to student misbehavior is sensitive to individual student needs and respects students' dignity.

- Student behavior is entirely appropriate; any student misbehavior is very minor and swiftly handled.
- The teacher silently and subtly monitors student behavior.
- Students respectfully intervene with classmates at appropriate moments to ensure compliance with standards of conduct.

- *A student suggests a revision to one of the classroom rules.*
- *The teacher notices that some students are talking among themselves and without a word moves nearer to them; the talking stops.*
- *The teacher speaks privately to a student about misbehavior.*
- *A student reminds her classmates of the class rule about chewing gum.*
- *And others...*

2e

ORGANIZING PHYSICAL SPACE

UNSATISFACTORY • LEVEL 1

The classroom environment is unsafe, or learning is not accessible to many. There is poor alignment between the arrangement of furniture and resources, including computer technology, and the lesson activities.

CRITICAL ATTRIBUTES

- There are physical hazards in the classroom, endangering student safety.
- Many students can't see or hear the teacher or see the board.
- Available technology is not being used even if it is available and its use would enhance the lesson.

POSSIBLE EXAMPLES

- *There are electrical cords running around the classroom.*
- *There is a pole in the middle of the room; some students can't see the board.*
- *A whiteboard is in the classroom, but it is facing the wall.*
- *And others...*

BASIC • LEVEL 2

The classroom is safe, and essential learning is accessible to most students. The teacher makes modest use of physical resources, including computer technology. The teacher attempts to adjust the classroom furniture for a lesson or, if necessary, to adjust the lesson to the furniture, but with limited effectiveness.

- The physical environment is safe, and most students can see and hear the teacher or see the board.
- The physical environment is not an impediment to learning but does not enhance it.
- The teacher makes limited use of available technology and other resources.

- *The teacher ensures that dangerous chemicals are stored safely.*
- *The classroom desks remain in two semicircles, requiring students to lean around their classmates during small-group work.*
- *The teacher tries to use a computer to illustrate a concept but requires several attempts to make the demonstration work.*
- *And others...*

PROFICIENT • LEVEL 3

The classroom is safe, and students have equal access to learning activities; the teacher ensures that the furniture arrangement is appropriate to the learning activities and uses physical resources, including computer technology, effectively.

- The classroom is safe, and all students are able to see and hear the teacher or see the board.
- The classroom is arranged to support the instructional goals and learning activities.
- The teacher makes appropriate use of available technology.

- *There are established guidelines concerning where backpacks are left during class to keep the pathways clear; students comply.*
- *Desks are moved together so that students can work in small groups, or desks are moved into a circle for a class discussion.*
- *The use of an Internet connection extends the lesson.*
- *And others...*

DISTINGUISHED • LEVEL 4

The classroom environment is safe, and learning is accessible to all students, including those with special needs. The teacher makes effective use of physical resources, including computer technology. The teacher ensures that the physical arrangement is appropriate to the learning activities. Students contribute to the use or adaptation of the physical environment to advance learning.

- Modifications are made to the physical environment to accommodate students with special needs.
- There is total alignment between the learning activities and the physical environment.
- Students take the initiative to adjust the physical environment.
- The teacher and students make extensive and imaginative use of available technology.

- *Students ask if they can shift the furniture to better suit small-group work or discussion.*
- *A student closes the door to shut out noise in the corridor or lowers a blind to block the sun from a classmate's eyes.*
- *A student suggests an application of the whiteboard for an activity.*
- *And others...*

DOMAIN 3 • INSTRUCTION

3a

COMMUNICATING WITH STUDENTS

UNSATISFACTORY • LEVEL 1

The instructional purpose of the lesson is unclear to students, and the directions and procedures are confusing. The teacher's explanation of the content contains major errors and does not include any explanation of strategies students might use. The teacher's spoken or written language contains errors of grammar or syntax. The teacher's academic vocabulary is inappropriate, vague, or used incorrectly, leaving students confused.

CRITICAL ATTRIBUTES

- At no time during the lesson does the teacher convey to students what they will be learning.
- Students indicate through body language or questions that they don't understand the content being presented.
- The teacher makes a serious content error that will affect students' understanding of the lesson.
- Students indicate through their questions that they are confused about the learning task.
- The teacher's communications include errors of vocabulary or usage or imprecise use of academic language.
- The teacher's vocabulary is inappropriate to the age or culture of the students.

BASIC • LEVEL 2

The teacher's attempt to explain the instructional purpose has only limited success, and/or directions and procedures must be clarified after initial student confusion. The teacher's explanation of the content may contain minor errors; some portions are clear, others difficult to follow. The teacher's explanation does not invite students to engage intellectually or to understand strategies they might use when working independently. The teacher's spoken language is correct but uses vocabulary that is either limited or not fully appropriate to the students' ages or backgrounds. The teacher rarely takes opportunities to explain academic vocabulary.

- The teacher provides little elaboration or explanation about what the students will be learning.
- The teacher's explanation of the content consists of a monologue, with minimal participation or intellectual engagement by students.
- The teacher makes no serious content errors but may make minor ones.
- The teacher's explanations of content are purely procedural, with no indication of how students can think strategically.
- The teacher must clarify the learning task so students can complete it.
- The teacher's vocabulary and usage are correct but unimaginative.
- When the teacher attempts to explain academic vocabulary, it is only partially successful.
- The teacher's vocabulary is too advanced, or too juvenile, for students.

PROFICIENT • LEVEL 3

The instructional purpose of the lesson is clearly communicated to students, including where it is situated within broader learning; directions and procedures are explained clearly and may be modeled. The teacher's explanation of content is scaffolded, clear, and accurate and connects with students' knowledge and experience. During the explanation of content, the teacher focuses, as appropriate, on strategies students can use when working independently and invites student intellectual engagement. The teacher's spoken and written language is clear and correct and is suitable to students' ages and interests. The teacher's use of academic vocabulary is precise and serves to extend student understanding.

- The teacher states clearly, at some point during the lesson, what the students will be learning.
- The teacher's explanation of content is clear and invites student participation and thinking.
- The teacher makes no content errors.
- The teacher describes specific strategies students might use, inviting students to interpret them in the context of what they're learning.
- Students engage with the learning task, indicating that they understand what they are to do.
- If appropriate, the teacher models the process to be followed in the task.
- The teacher's vocabulary and usage are correct and entirely suited to the lesson, including, where appropriate, explanations of academic vocabulary.
- The teacher's vocabulary is appropriate to students' ages and levels of development.

- *The teacher says, "By the end of today's lesson you're all going to be able to factor different types of polynomials."*
- *In the course of a presentation of content, the teacher asks students, "Can anyone think of an example of that?"*
- *The teacher uses a board or projection device for task directions so that students can refer to it without requiring the teacher's attention.*
- *The teacher says, "When you're trying to solve a math problem like this, you might think of a similar, but simpler, problem you've done in the past and see whether the same approach would work."*
- *The teacher explains passive solar energy by inviting students to think about the temperature in a closed car on a cold, but sunny, day or about the water in a hose that has been sitting in the sun.*
- *The teacher uses a Venn diagram to illustrate the distinctions between a republic and a democracy.*
- *And others...*

DISTINGUISHED • LEVEL 4

The teacher links the instructional purpose of the lesson to the larger curriculum; the directions and procedures are clear and anticipate possible student misunderstanding. The teacher's explanation of content is thorough and clear, developing conceptual understanding through clear scaffolding and connecting with students' interests. Students contribute to extending the content by explaining concepts to their classmates and suggesting strategies that might be used. The teacher's spoken and written language is expressive, and the teacher finds opportunities to extend students' vocabularies, both within the discipline and for more general use. Students contribute to the correct use of academic vocabulary.

- If asked, students are able to explain what they are learning and where it fits into the larger curriculum context.
- The teacher explains content clearly and imaginatively, using metaphors and analogies to bring content to life.
- The teacher points out possible areas for misunderstanding.
- The teacher invites students to explain the content to their classmates.
- Students suggest other strategies they might use in approaching a challenge or analysis.
- The teacher uses rich language, offering brief vocabulary lessons where appropriate, both for general vocabulary and for the discipline.
- Students use academic language correctly.

- *The teacher says, "Here's a spot where some students have difficulty; be sure to read it carefully."*
- *The teacher asks a student to explain the task to other students.*
- *When clarification about the learning task is needed, a student offers it to classmates.*
- *The teacher, in explaining the westward movement in U.S. history, invites students to consider that historical period from the point of view of the Native Peoples.*
- *The teacher asks, "Who would like to explain this idea to us?"*
- *A student asks, "Is this another way we could think about analogies?"*
- *A student explains an academic term to classmates.*
- *The teacher pauses during an explanation of the civil rights movement to remind students that the prefix in- as in inequality means "not" and that the prefix un- also means the same thing.*
- *A student says to a classmate, "I think that side of the triangle is called the hypotenuse."*
- *And others...*

3b

USING QUESTIONING AND DISCUSSION TECHNIQUES

UNSATISFACTORY • LEVEL 1

The teacher's questions are of low cognitive challenge, with single correct responses, and are asked in rapid succession. Interaction between the teacher and students is predominantly recitation style, with the teacher mediating all questions and answers; the teacher accepts all contributions without asking students to explain their reasoning. Only a few students participate in the discussion.

CRITICAL ATTRIBUTES

- Questions are rapid-fire and convergent, with a single correct answer.
- Questions do not invite student thinking.
- All discussion is between the teacher and students; students are not invited to speak directly to one another.
- The teacher does not ask students to explain their thinking.
- Only a few students dominate the discussion.

POSSIBLE EXAMPLES

- *All questions are of the "recitation" type, such as "What is 3 x 4?"*
- *The teacher asks a question for which the answer is on the board; students respond by reading it.*
- *The teacher calls only on students who have their hands up.*
- *A student responds to a question with wrong information, and the teacher doesn't follow up.*
- *And others...*

BASIC • LEVEL 2

The teacher's questions lead students through a single path of inquiry, with answers seemingly determined in advance. Alternatively, the teacher attempts to ask some questions designed to engage students in thinking, but only a few students are involved. The teacher attempts to engage all students in the discussion, to encourage them to respond to one another, and to explain their thinking, with uneven results.

- The teacher frames some questions designed to promote student thinking, but many have a single correct answer, and the teacher calls on students quickly.
- The teacher invites students to respond directly to one another's ideas, but few students respond.
- The teacher calls on many students, but only a small number actually participate in the discussion.
- The teacher asks students to explain their reasoning, but only some students attempt to do so.

- *Many questions are of the "recitation" type, such as "How many members of the House of Representatives are there?"*
- *The teacher asks, "Who has an idea about this?" The usual three students offer comments.*
- *The teacher asks, "Maria, can you comment on Ian's idea?" but Maria does not respond or makes a comment directly to the teacher.*
- *The teacher asks a student to explain his reasoning for why 13 is a prime number but does not follow up when the student falters.*
- *And others...*

PROFICIENT • LEVEL 3

While the teacher may use some low-level questions, he poses questions designed to promote student thinking and understanding. The teacher creates a genuine discussion among students, providing adequate time for students to respond and stepping aside when doing so is appropriate. The teacher challenges students to justify their thinking and successfully engages most students in the discussion, employing a range of strategies to ensure that most students are heard.

- The teacher uses open-ended questions, inviting students to think and/or offer multiple possible answers.
- The teacher makes effective use of wait time.
- Discussions enable students to talk to one another without ongoing mediation by teacher.
- The teacher calls on most students, even those who don't initially volunteer.
- Many students actively engage in the discussion.
- The teacher asks students to justify their reasoning, and most attempt to do so.

- *The teacher asks, "What might have happened if the colonists had not prevailed in the American war for Independence?"*
- *The teacher uses the plural form in asking questions, such as "What are some things you think might contribute to _____?"*
- *The teacher asks, "Maria, can you comment on Ian's idea?" and Maria responds directly to Ian.*
- *The teacher poses a question, asking every student to write a brief response and then share it with a partner, before inviting a few to offer their ideas to the entire class.*
- *The teacher asks students when they have formulated an answer to the question "Why do you think Huck Finn did _____?" to find the reason in the text and to explain their thinking to a neighbor.*
- *And others...*

DISTINGUISHED • LEVEL 4

The teacher uses a variety or series of questions or prompts to challenge students cognitively, advance high-level thinking and discourse, and promote metacognition. Students formulate many questions, initiate topics, challenge one another's thinking, and make unsolicited contributions. Students themselves ensure that all voices are heard in the discussion.

- Students initiate higher-order questions.
- The teacher builds on and uses student responses to questions in order to deepen student understanding.
- Students extend the discussion, enriching it.
- Students invite comments from their classmates during a discussion and challenge one another's thinking.
- Virtually all students are engaged in the discussion.

- *A student asks, "How many ways are there to get this answer?"*
- *A student says to a classmate, "I don't think I agree with you on this, because..."*
- *A student asks of other students, "Does anyone have another idea how we might figure this out?"*
- *A student asks, "What if...?"*
- *And others...*

UNSATISFACTORY • LEVEL 1

The learning tasks/activities, materials, and resources are poorly aligned with the instructional outcomes, or require only rote responses, with only one approach possible. The groupings of students are unsuitable to the activities. The lesson has no clearly defined structure, or the pace of the lesson is too slow or rushed.

CRITICAL ATTRIBUTES

- Few students are intellectually engaged in the lesson.
- Learning tasks/activities and materials require only recall or have a single correct response or method.
- Instructional materials used are unsuitable to the lesson and/or the students.
- The lesson drags or is rushed.
- Only one type of instructional group is used (whole group, small groups) when variety would promote more student engagement.

POSSIBLE EXAMPLES

- *Most students disregard the assignment given by the teacher; it appears to be much too difficult for them.*
- *Students fill out the lesson worksheet by copying words from the board.*
- *Students are using math manipulative materials in a rote activity.*
- *The teacher lectures for 45 minutes.*
- *Most students don't have time to complete the assignment; the teacher moves on in the lesson.*
- *And others...*

BASIC • LEVEL 2

The learning tasks and activities are partially aligned with the instructional outcomes but require only minimal thinking by students and little opportunity for them to explain their thinking, allowing most students to be passive or merely compliant. The groupings of students are moderately suitable to the activities. The lesson has a recognizable structure; however, the pacing of the lesson may not provide students the time needed to be intellectually engaged or may be so slow that many students have a considerable amount of "downtime."

- Some students are intellectually engaged in the lesson.
- Learning tasks are a mix of those requiring thinking and those requiring recall.
- Student engagement with the content is largely passive; the learning consists primarily of facts or procedures.
- The materials and resources are partially aligned to the lesson objectives.
- Few of the materials and resources require student thinking or ask students to explain their thinking.
- The pacing of the lesson is uneven—suitable in parts but rushed or dragging in others.
- The instructional groupings used are partially appropriate to the activities.

- *Students in only three of the five small groups are figuring out an answer to the assigned problem; the others seem to be unsure how they should proceed.*
- *Students are asked to fill in a worksheet, following an established procedure.*
- *There is a recognizable beginning, middle, and end to the lesson.*
- *The teacher lectures for 20 minutes and provides 15 minutes for the students to write an essay; not all students are able to complete it.*
- *And others...*

PROFICIENT • LEVEL 3

The learning tasks and activities are fully aligned with the instructional outcomes and are designed to challenge student thinking, inviting students to make their thinking visible. This technique results in active intellectual engagement by most students with important and challenging content, and with teacher scaffolding to support that engagement. The groupings of students are suitable to the activities. The lesson has a clearly defined structure, and the pacing of the lesson is appropriate, providing most students the time needed to be intellectually engaged.

- Most students are intellectually engaged in the lesson.
- Most learning tasks have multiple correct responses or approaches and/or encourage higher-order thinking.
- Students are invited to explain their thinking as part of completing tasks.
- Materials and resources support the learning goals and require intellectual engagement, as appropriate.
- The pacing of the lesson provides students the time needed to be intellectually engaged.
- The teacher uses groupings that are suitable to the lesson activities.

- *Five students (out of 27) have finished an assignment early and begin talking among themselves; the teacher assigns a follow-up activity.*
- *Students are asked to formulate a hypothesis about what might happen if the American voting system allowed for the direct election of presidents and to explain their reasoning.*
- *Students are given a task to do independently, then to discuss with a table group, followed by a reporting from each table.*
- *Students are asked to create different representations of a large number using a variety of manipulative materials.*
- *The lesson is neither rushed nor does it drag.*
- *And others...*

DISTINGUISHED • LEVEL 4

Virtually all students are intellectually engaged in challenging content through well-designed learning tasks and activities that require complex thinking by students. The teacher provides suitable scaffolding and challenges students to explain their thinking. There is evidence of some student initiation of inquiry and student contributions to the exploration of important content; students may serve as resources for one another. The lesson has a clearly defined structure, and the pacing of the lesson provides students the time needed not only to intellectually engage with and reflect upon their learning but also to consolidate their understanding.

- Virtually all students are intellectually engaged in the lesson.
- Lesson activities require high-level student thinking and explanations of their thinking.
- Students take initiative to improve the lesson by (1) modifying a learning task to make it more meaningful or relevant to their needs, (2) suggesting modifications to the grouping patterns used, and/or (3) suggesting modifications or additions to the materials being used.
- Students have an opportunity for reflection and closure on the lesson to consolidate their understanding.

- *Students are asked to write an essay in the style of Hemingway and to describe which aspects of his style they have incorporated.*
- *Students determine which of several tools—e.g., a protractor, spreadsheet, or graphing calculator—would be most suitable to solve a math problem.*
- *A student asks whether they might remain in their small groups to complete another section of the activity, rather than work independently.*
- *Students identify or create their own learning materials.*
- *Students summarize their learning from the lesson.*
- *And others...*

3d USING ASSESSMENT IN INSTRUCTION

UNSATISFACTORY • LEVEL 1

Students do not appear to be aware of the assessment criteria, and there is little or no monitoring of student learning; feedback is absent or of poor quality. Students do not engage in self- or peer assessment.

CRITICAL ATTRIBUTES

- The teacher gives no indication of what high-quality work looks like.
- The teacher makes no effort to determine whether students understand the lesson.
- Students receive no feedback, or feedback is global or directed to only one student.
- The teacher does not ask students to evaluate their own or classmates' work.

POSSIBLE EXAMPLES

- *A student asks, "How is this assignment going to be graded?"*
- *A student asks, "Is this the right way to solve this problem?" but receives no information from the teacher.*
- *The teacher forges ahead with a presentation without checking for understanding.*
- *After the students present their research on globalization, the teacher tells them their letter grade; when students ask how he arrived at the grade, the teacher responds, "After all these years in education, I just know what grade to give."*
- *And others...*

BASIC • LEVEL 2

Students appear to be only partially aware of the assessment criteria, and the teacher monitors student learning for the class as a whole. Questions and assessments are rarely used to diagnose evidence of learning. Feedback to students is general, and few students assess their own work.

- There is little evidence that the students understand how their work will be evaluated.
- The teacher monitors understanding through a single method, or without eliciting evidence of understanding from students.
- Feedback to students is vague and not oriented toward future improvement of work.
- The teacher makes only minor attempts to engage students in self- or peer assessment.

- *The teacher asks, "Does anyone have a question?"*
- *When a student completes a problem on the board, the teacher corrects the student's work without explaining why.*
- *The teacher says, "Good job, everyone."*
- *The teacher, after receiving a correct response from one student, continues without ascertaining whether other students understand the concept.*
- *The students receive their tests back; each one is simply marked with a letter grade at the top.*
- *And others...*

PROFICIENT • LEVEL 3

Students appear to be aware of the assessment criteria, and the teacher monitors student learning for groups of students. Questions and assessments are regularly used to diagnose evidence of learning. Teacher feedback to groups of students is accurate and specific; some students engage in self-assessment.

- The teacher makes the standards of high-quality work clear to students.
- The teacher elicits evidence of student understanding.
- Students are invited to assess their own work and make improvements; most of them do so.
- Feedback includes specific and timely guidance, at least for groups of students.

- *The teacher circulates during small-group or independent work, offering suggestions to students.*
- *The teacher uses specifically formulated questions to elicit evidence of student understanding.*
- *The teacher asks students to look over their papers to correct their errors; most of them engage in this task.*
- *And others...*

DISTINGUISHED • LEVEL 4

Assessment is fully integrated into instruction, through extensive use of formative assessment. Students appear to be aware of, and there is some evidence that they have contributed to, the assessment criteria. Questions and assessments are used regularly to diagnose evidence of learning by individual students. A variety of forms of feedback, from both teacher and peers, is accurate and specific and advances learning. Students self-assess and monitor their own progress. The teacher successfully differentiates instruction to address individual students' misunderstandings.

- Students indicate that they clearly understand the characteristics of high-quality work, and there is evidence that students have helped establish the evaluation criteria.
- The teacher is constantly "taking the pulse" of the class; monitoring of student understanding is sophisticated and continuous and makes use of strategies to elicit information about individual student understanding.
- Students monitor their own understanding, either on their own initiative or as a result of tasks set by the teacher.
- High-quality feedback comes from many sources, including students; it is specific and focused on improvement.

- *The teacher reminds students of the characteristics of high-quality work, observing that the students themselves helped develop them.*
- *While students are working, the teacher circulates, providing specific feedback to individual students.*
- *The teacher uses popsicle sticks or exit tickets to elicit evidence of individual student understanding.*
- *Students offer feedback to their classmates on their work.*
- *Students evaluate a piece of their writing against the writing rubric and confer with the teacher about how it could be improved.*
- *And others...*

3e

DEMONSTRATING FLEXIBILITY AND RESPONSIVENESS

UNSATISFACTORY • LEVEL 1

The teacher ignores students' questions; when students have difficulty learning, the teacher blames them or their home environment for their lack of success. The teacher makes no attempt to adjust the lesson even when students don't understand the content.

CRITICAL ATTRIBUTES

- The teacher ignores indications of student boredom or lack of understanding.
- The teacher brushes aside students' questions.
- The teacher conveys to students that when they have difficulty learning, it is their fault.
- In reflecting on practice, the teacher does not indicate that it is important to reach all students.
- The teacher makes no attempt to adjust the lesson in response to student confusion.

POSSIBLE EXAMPLES

- *The teacher says, "We don't have time for that today."*
- *The teacher says, "If you'd just pay attention, you could understand this."*
- *When a student asks the teacher to explain a mathematical procedure again, the teacher says, "Just do the homework assignment; you'll get it then."*
- *And others...*

BASIC • LEVEL 2

The teacher accepts responsibility for the success of all students but has only a limited repertoire of strategies to use. Adjustment of the lesson in response to assessment is minimal or ineffective.

- The teacher makes perfunctory attempts to incorporate students' questions and interests into the lesson.
- The teacher conveys to students a level of responsibility for their learning but also his uncertainty about how to assist them.
- In reflecting on practice, the teacher indicates the desire to reach all students but does not suggest strategies for doing so.
- The teacher's attempts to adjust the lesson are partially successful.

- *The teacher says, "I'll try to think of another way to come at this and get back to you."*
- *The teacher says, "I realize not everyone understands this, but we can't spend any more time on it."*
- *The teacher rearranges the way the students are grouped in an attempt to help students understand the lesson; the strategy is partially successful.*
- *And others...*

PROFICIENT • LEVEL 3

The teacher successfully accommodates students' questions and interests. Drawing on a broad repertoire of strategies, the teacher persists in seeking approaches for students who have difficulty learning. If impromptu measures are needed, the teacher makes a minor adjustment to the lesson and does so smoothly.

- The teacher incorporates students' interests and questions into the heart of the lesson.
- The teacher conveys to students that she has other approaches to try when the students experience difficulty.
- In reflecting on practice, the teacher cites multiple approaches undertaken to reach students having difficulty.
- When improvising becomes necessary, the teacher makes adjustments to the lesson.

- *The teacher says, "That's an interesting idea; let's see how it fits."*
- *The teacher illustrates a principle of good writing to a student, using his interest in basketball as context.*
- *The teacher says, "This seems to be more difficult for you than I expected; let's try this way," and then uses another approach.*
- *And others...*

DISTINGUISHED • LEVEL 4

The teacher seizes an opportunity to enhance learning, building on a spontaneous event or students' interests, or successfully adjusts and differentiates instruction to address individual student misunderstandings. Using an extensive repertoire of instructional strategies and soliciting additional resources from the school or community, the teacher persists in seeking effective approaches for students who need help.

- The teacher seizes on a teachable moment to enhance a lesson.
- The teacher conveys to students that she won't consider a lesson "finished" until every student understands and that she has a broad range of approaches to use.
- In reflecting on practice, the teacher can cite others in the school and beyond whom he has contacted for assistance in reaching some students.
- The teacher's adjustments to the lesson, when they are needed, are designed to assist individual students.

- *The teacher stops a lesson midstream and says, "This activity doesn't seem to be working. Here's another way I'd like you to try it."*
- *The teacher incorporates the school's upcoming championship game into an explanation of averages.*
- *The teacher says, "If we have to come back to this tomorrow, we will; it's really important that you understand it."*
- *And others...*

Appendix H: Position Paper

Basic Skills Achievement Gap: Five Recommendations to Improve Learning

Introduction

Educators need to address mathematics underachievement in the United States for several reasons. First, mathematics knowledge is paramount to our countries success in a technologically advanced world (Ayotola & Adedeji, 2009). Secondly, mathematics knowledge “serves as a gatekeeper to high-status occupations” (Lubienski, 2007, p.55). In addition, students need to reach proficiency levels on state assessments in order to graduate. Finally, districts need to meet state regulations regarding student growth objectives and annual performance goals. These pressures increase the importance that educators address mathematics learning deficits to ensure teacher and student success.

The basic skills mathematics population at Oak Brook School continued to underachieve on mathematics performance assessments despite receiving intervention programs. The basic skills population was defined as general education students who scored at the partially proficient level in mathematics on the New Jersey Assessment of Skills and Knowledge (NJ ASK). According to the New Jersey State Report Card, 12% of the total student population at Oak Brook School scored below the proficient level on the 2012 NJ ASK (NJDOE, 2012).

A qualitative case study was conducted to investigate sixth grade Oak Brook teachers’ perceptions about mathematics instruction for basic skills students and a review of current literature findings provided insight into issues surrounding underachievement of basis skills students. Teachers identified the leveling policy used to place students as

the biggest barrier to improving mathematics performance of basic skills students. This position paper is based on teachers' experiences in instructing low-level classes and current research about track systems to present recommendations for improving the student placement system at Oak Brook School. The position paper:

- Provides a summary of federal and state regulations regarding student placement;
- Provides background about the current placement policy at Oak Brook School;
- Explains the case study and research findings related to track systems;
- Presents research findings related to alternative placement strategies;
- Suggests strategies to address the issues surrounding track systems.

Background

Regulations and Laws

The federal and New Jersey state regulations on student placement do not provide specific mandates on how to organize students. Instead, the regulations present general guidelines to follow that are in line with the No Child Left Behind mandate to provide all students with a high-quality education, challenging state standards, and a least restrictive environment (U. S. Department of Education, 2001). In accordance with the policy, the federal law states that schools must provide research-based instruction, programs, and resources to meet students' needs and ensure that students meet proficiency levels (U. S. Department of Education, 2001). State and district policy makers, however, decided specific program requirements are decided by.

The New Jersey State Department of Education (NJDOE) mandates that schools provide students with an appropriate education that equips students with skills to attain the Common Core State Standards (NJDOE, 2013). State regulations (6A:8) require schools to modify programs by differentiating instructional content, process, products, and learning environments to increase the chance that students will attain knowledge and skills outlined in the Common Core State Standards (NJDOE, 2013). The policy makers (6A:8) do not endorse a particular model for student placement, but the policy outlines guidelines for using pullout programs, classroom-based differentiation, acceleration, flexible pacing, compacted curriculum, distance learning, advanced classes, and individualized programs as viable options (NJDOE, 2013). The NJDOE leaves the specific placement decisions up to the local board of education (NJDOE, 2013).

Placement Policy at Oak Brook School

The current student placement policy at Oak Brook School in mathematics is to place students in a track system based on student ability. School administrators sort students into four levels, Pre-Algebra A, Pre-Algebra B, general education A, and general education B, based on performance on standardized assessments, teacher recommendation, and other related measures. Teachers differentiate pace and content based on class level. In addition, Oak Brook School provides supplemental programs for Special Education, English Language Learner (ELL), and basis skills students.

Case Study and Literature findings for Track Systems

Data from the case study and current researchers revealed benefits associated with track systems. Oak Brook teachers explained that track systems improved teachers'

ability to meet students' needs since students in the classes were similar in ability.

Research findings indicated that ability grouping provided schools with the opportunity to design classes based on matching teacher strengths with student' needs (Hornby, Witt, & Mitchell, 2011). Observational data indicated that students at Oak Brook benefitted from the low-level class because teachers modified the content and pace of the lesson in response to students' needs. The Oak Brook teachers provided individualized support in all 15 observations conducted during the project study.

Students also benefitted from track systems in the area of self-confidence.

Teachers from current research studies stated that the ability-grouping design reduced negative consequences of peer-comparisons and improved confidence levels in low-level classrooms (Frenzel, 2010). Oak Brook teachers related gains in confidence to development of more realistic expectations when being compared to students with similar abilities. Research findings also indicated that students in low-level classes developed positive attitudes about school and relationships with teachers as a result of realistic expectations set and extra help provided by teachers (Venkat & Brown, 2009).

Differentiated expectations provided students with the opportunity to experience success and positive feelings about their abilities.

The last benefit to implementing track systems related to performance. High-performing students made great progress in tracked environments. Students in the literature review studies explained that advanced courses improved their preparation for college, expanded career choices, increased SAT performance, and increased honor's memberships (Spielhagen, 2010). Other research indicated that high-track environments

provided the opportunity for healthy challenge levels, mathematical conversations, and interest for high-performing students (Forgasz, 2010). Track systems also provided the atmosphere conditions for schools to developed a healthy incentive effect for some high-performing students as students strived to achieve high test scores to earn placement into upper tracks (Koerselman, 2012). Research findings also indicated that low-level students in track systems made modest gains in achievement in pullout programs (Dunne, Depaepe, & Verschaffel, 2011).

The benefits of track systems provided opportunities for districts to address federal and state regulations that stated that schools must design programs to meet students' needs and ensure progress toward proficiency levels. Track systems provided opportunities to modify content and pace and to implement services for gifted and talented, Special Education, ELL, and basic skills populations. The services helped schools improve proficiency levels based on findings that performance gains were made for low and high-level students.

Even though case study and literature findings indicated a few benefits to track systems, researchers suggested that schools avoid tracking polices due to the fact that consequences associated with tracking students seemed to outweigh the benefits (LaPrade, 2011). The three areas of consequences for track systems were related to negative effects on student characteristics, underachievement of basic skills students, and inequality issues.

Negative Effects on Student Characteristics

Oak Brook teachers reported that leveled-classroom environments negatively impacted student self-efficacy, independence, and work ethic. Oak Brook teachers identified the area of self-confidence as problematic for some basic skills students and commented that performance pressure negatively impacted student self-confidence in the low-track. Teachers also explained that some low-track students experienced frustration with low grades and viewed themselves as failures when underachieving. Observational data provided examples of student disappointment with performance. In one class, students slumped down on the desk and flipped the test paper over when they received a low grade. Research findings also supported the idea that low-track students struggled with self-confidence issues. One study indicated that middle and high school students in the most stratified systems displayed the least amount of self-confidence and within that, the lowest track presented the lowest self-confidence levels (Ireson & Hallam, 2009). Case study findings also indicated that track systems had negative impacts on student independence levels. Oak Brook teachers discussed that low-level students displayed low independence levels. Teachers stated that most low-level students were unable to work through mathematics problems on their own and struggled with most mathematical concepts. Oak Brook teachers expressed frustration that low-level students were not mathematical leaders and often explained mathematical processes incorrectly to other low-level students. Oak Brook teachers also explained how the issue with independence prevented the use of cooperative learning and student-centered activities and prevented teachers from using small group instruction to meet students' needs. The observational data indicated that students struggled with independence in the low-level track. In 73%

of the observations, teachers spent approximately half the class period reviewing solutions to homework, and in 50% of the observations; teachers spent the entire instructional time guiding students through the acquisition of a new concept. Research findings also indicated issues related to independence in that low-track students displayed an over-reliance on teacher help and explanations (Marks, 2014).

The last student characteristic negatively impacted by track systems was related to work ethic. Oak Brook teachers described low-track students as non-participatory. One teacher stated that basic skills students often take the back seat to other students during group work. Teachers expressed concerns that students in low tracks did not have mathematics leaders in the class to serve as role models for positive mathematical habits. Oak Brook teachers explained that a lack of role models de-motivated low-level students. Observational data indicated Oak Brook students displayed a lack of motivation to persevere through mathematical problems. In one observation, students were working on a review packet, and the teacher had to address off-task behavior of several students within a short time frame. In another situation, students were required to work with a partner to solve area problems. Several pairs of students were socializing instead of solving problems. The teacher had to refocus students more than once. Research also found evidence of poor work ethics in low tracks. Students in low-level classes reported a perceived notion that teachers spend a significant amount of class time controlling behavior (Kususanto, Ismail, & Jamil, 2010). Students in low tracks described themselves as lacking study skills, preferring easier work, and displaying disruptive behavior in class (Spielhagen, 2010).

The negative impact of track systems is in conflict with the school's obligation to meet federal and state regulations. Low self-confidence issues, performance pressures, and negative behavior presented in low-tracks conflict with providing the least-restrictive environment described by the federal government. The inability to use cooperative learning strategies interferes with the federal mandate to use research-based practices. An inability to develop independence in solving mathematics tasks conflicts with federal and state mandates to provide the appropriate education to prepare students to reach proficiency levels.

Underachievement of Basic Skills Students

Basic skills students at Oak Brook School have a history of underachievement. A school-level analysis from the 2011-2012 school year indicated that roughly 33% of the basic skills student population failed to achieve the proficient level on the NJ ASK in mathematics. A few Oak Brook teachers commented that the biggest challenge in teaching low-level students was lack of progress in performance. Observational data provided information to document the issue of low gains. In one particular Oak Brook observation, approximately 50% of the class scored below 70% on a unit assessment despite the teacher's attempt to modify the pace, provide guided practice and teacher feedback, and meet individual needs. Current research findings indicated the primary students in track systems made modest academic gains, but middle and high school students did not indicate the same positive results (Marks, 2014). Researchers revealed that low-track students made 5 ½ months less progress than high-track students at the middle and high school levels (Marks, 2014). Case study and research findings indicated

that low-track students continued to underachieve in comparison to other students, and Oak Brook School continued to struggle to meet federal and state mandates to ensure that all students reach proficiency levels.

Inequality Issues in Track Systems

Case study data and research findings indicated that track systems led to inequality gaps in curriculum and expectations. Oak Brook teachers discussed that they modified the pace and level of practice problems in low-track classes. Oak Brook teachers also explained that they struggled to cover curriculum standards with lower-level classes due to time, pace, and retention issues. Research findings indicated that other teachers also modified instruction for low-level students. Findings indicated that teachers decreased the challenge level of materials for low-level students (Schillar, Schmidt, Muller, & Huang, 2010). Other research indicated that teachers reduced workloads, used below grade-level material, and incorporated small numbers in mathematical problems for low-level students (Marks, 2014). Modifying curriculum and pacing could cause a curriculum gap for low-track students, as teachers may not cover the same amount of curriculum at the same level of rigor as in higher tracks. Research findings indicated that lower-tracks courses cover approximately 40% less curriculum a year than higher-tracks (Schillar et al., 2010).

Researchers also discovered that low-track programs often offered different mathematics courses than high-track programs. Findings indicated that lower-course expectations decreased opportunities for students in college and life (Kelly & Carbonaro, 2012). The Oak Brook School track system was designed to present different courses for

high and low-track students. High-track students take pre-algebra and low-track students take general mathematics. The focus of the courses is not the same, and the school uses different textbooks for each course. Research found that low-level tracks courses often used different textbooks of lesser quality than high-level courses. Findings indicated that low-level textbooks included simple recall and routine problems as compared to high-level textbooks that contain higher level questions, problem-solving, and multiple solution problems (El-Haj & Rubin, 2009). Modifications made for low-track students by Oak Brook teachers and in some research studies could create curriculum achievement gaps for low-level students.

Another area of inequality was in teacher expectations of low-track students. Oak Brook teachers described low-track students as having less mathematical ability and displaying less ability to engage in mathematical conversations than high-level students. Teachers expressed lower expectations of students by stating that basic skills students were working up to their ability. Research indicated that 90% of teachers expected high track students to go to college while only 40% of teachers felt the same about low-track students (Kelly & Carbonaro, 2014). Findings also indicated that teachers in research literature also described students negatively. Teachers described students having a lack of ability, a negative attitude, and behavior problems (Stevens & Vermeersch, 2010). Oak Brook teachers described students as reluctant to use mathematical strategies to improve performance, which aligned with research findings about attitude.

The final area of inequality in track systems pertained to fixed-ability thinking. Research findings indicated that teachers in low-tracks labeled students as having

disabilities and categorized them based on an innate theory about intelligence (El-Haj & Rubin, 2009). Teachers attributed ability to IQ and genetics (Marks, 2012). Students in literature studies defined their ability based on track placement (Marks, 2013). Oak Brook teachers displayed signs of fixed-ability thinking in the comments made during interviews. A few teachers stated that students were placed into basic skills because learning was more difficult for them when compared to other learners.

Inequality in curriculum and expectations could prevent Oak Brook School from meeting federal and state regulations related to student learning. Although Oak Brook teachers' adjustments in content and pace for low-track students were in line with state regulations to modify instruction to meet students' needs, the lower expectations and adjustments prevented Oak Brook School from presenting challenging state standards. Modifications to use below grade level materials and decode mathematical problems reduced the rigor level and Oak Brook personnel's ability to provide a high-quality education. The inequality that existed in the track systems prevented the district from meeting the federal mandate to provide the least restrictive environment.

Summary of Track Systems

Track system organization benefitted students in that high-level and primary students made increased gains in achievement. Track system characteristics helped teachers to modify the pace of instruction and provide extra support to meet low-level students' needs. Students benefitted from realistic expectations established by teachers in low-tracks and from comparisons to students of similar ability. Some students benefitted from increased confidence in low-track classes. The consequences of track systems were

more extensive. Performance of middle and high school students in low-tracks was negatively impacted by ability-grouping policies. Modifications made to instruction created curriculum gaps for low-track students. Teachers tended to adopt lower expectations for low-track students and demographic gaps and fixed-ability thinking were intensified as a result of track systems. Negative results of track systems interfered with Oak Brook School's compliance with state and federal policies.

Alternative Placement Strategies

Benefits to De-track Systems

Researchers suggested that the alternative to a track system was to de-track students (Allensworth, Nomi, Montgomery, & Lee, 2009; LaPrade, 2011). Students received the same educational experience regardless of ability in a de-tracked environment (LaPrade, 2011). The literature review findings indicated that there were benefit for students in de-track settings. The most common research finding in support of mixed-ability groupings related to accessibility of curriculum. Domina and Saldana (2012) found that standardized curriculum policies provided opportunities for increased accessibility of mathematics courses as 4.5 Carnegie units in mathematics per student increased 4.5 points from 1982 to 2004. Results also indicated a modest improvement in test scores for all students but especially low-attaining students. Enrollment in trigonometry and higher courses rose from 19% in 1982 to 43% in 2004, and calculus enrollment increased from 5% to 14%. Hall (2012) found that adding more years and number of courses to lower level high school tracks increased student attainment by 40%.

De-tracking school policies had a positive impact in meeting students' needs. Hornby et al. (2011) determined that mixed-ability classrooms provided opportunities for sixth grade teachers' to meet diverse needs and inspire low-level pupils with the influence of higher-level students. Teachers suggested that low-level students responded better to help from classmates because low students were more comfortable when they were not being singled out. Oak Brook teachers stated that blending high and low students inspired low-level students to work harder.

Venkat and Brown (2009) determined that students in mixed-ability settings demonstrated similar achievement as students in tracked settings, and Allensworth et al. (2009) determined that universalizing college preparatory curriculum in high school did not affect the dropout rate for low-attaining students. The results from Venkat and Brown and Allensworth et al. indicated that mixed policies did not negatively affect performance and attendance.

Researchers suggested that de-track policies would address the issues discussed by Oak Brook teachers during the interview process. A few teachers expressed frustration that basic skills students made small gains. Researchers found evidence that de-track systems improved learning for high school students (Hall, 2012). Oak Brook teachers were also frustrated with the high number of struggling learners in the tracked class. Research findings indicated that de-track systems eliminated the issue by mixing all levels together. Additionally, Oak Brook teachers expressed frustration that low-level classes lacked mathematical role models. Mixed-ability classrooms infused middle- and high-level students in all classes, which increased the number of mathematical leaders in

each class (Hornby et al., 2011). The mathematical leaders could enable Oak Brook teachers to use cooperative learning and student-centered learning activities. The de-track system also reduced inequality issues suggested by current literature. Mixed-ability classrooms provided uniform conditions so that all students experienced the same curriculum, which reduced the curriculum and expectation gap (LaPrade, 2011).

De-track systems also provided opportunities for teachers to use instructional processes that aligned with federal and state regulations. School personnel decisions to increase student access to high-level courses aligned with the state and federal regulation to provide a high-quality education that is based on challenging standards.

Implementation of cooperative learning helped schools to address state and federal mandates to meet student' needs and requirements to use research-based strategies. The narrowed achievement gaps that resulted from de-track environments help the school personnel to comply with federal requirements to provide least restrictive environments.

Consequences to De-Track Systems

A few researchers identified consequences that resulted from de-tracked classrooms. One study indicated that increasing access to college-level courses in high schools contributed to a 3% increase in failure rate for low students, 8.9% decrease in grades across different abilities, and a drop in final GPA's for all students except the low-ability level (Allensworth et al., 2009). Allensworth et al. (2009) also found that universalizing curriculum increased the chance that the lowest students would not attend college by 2.8%. The policy did not change the amount of low-level students enrolling in courses beyond geometry.

The Hall (2012) pilot study measuring effectiveness of tracking indicated that opening up access to more academic courses affected dropout rates negatively. Findings indicated that an increase in academic content in lower tracks increased the dropout rate by 3.8%. Buchman and Park (2009) determined that undifferentiated school environments increased students' unrealistic expectations about attending college. Survey results indicated that 60% of students planned to go to college but in reality only 33% actually attended college. Students in Venkat and Brown's (2009) study involved in mixed-settings demonstrated negative outlooks about the environment. The seventh-ninth grade students described the class as boring and discussed frustration with behavior problems of other students within the class.

Researchers revealed some teacher frustration with de-tracked systems. Teachers in the study conducted by El-Haj and Rubin (2009) expressed concern with a lack of resources to teach varying levels, skills, and learning styles in a mixed-ability classroom. Teachers in the Harris (2011) study described frustration in balancing demands of high-stakes testing with needs of students. The consequences of de-track systems cause concerns about meeting federal and state mandates. The negative effect on performance, college attendance, and attitude interfered with the schools' compliance with providing programs and resources that ensure that students reach proficiency levels on standards. Schools need to address negative factors associated with de-track systems in order for de-tracking to be a viable solution to placement and performance issues at Oak Brook School.

Researchers on student placement highlighted several benefits and consequences for both track and de-tracked systems. Most educational approaches present both benefits and consequences. Many research results from the review of literature indicated that high-performing students stand to gain more than low-performing students in track systems (Huang, 2009). Researchers suggested that school efforts to meet the needs of top-performing group should not disadvantage low-performing groups (Forgasz, 2010; Spielhagen, 2010). As a result, the majority of researchers in the literature review suggested that schools institute a de-tracking policy. Moreover, the use of track systems presented more consequences than the use of de-track systems while the benefits of de-tracking systems presented solutions to frustrations expressed by teachers during the interview process. The conclusion drawn from the literature review and case study analysis of teacher perceptions drove the recommendation for Oak Brook School to de-track mathematics classrooms. Providing teachers with support and training in mixed-ability teaching will reduce potential consequences associated with de-track practices.

A Plan for Closing the Basic Skills Achievement Gap

Based on an analysis of teacher perceptions surrounding underachievement of basic skills students and research on track and de-track systems, I recommend that Oak Brook school change from a track system to a de-track system in mathematics. De-track systems organize students into mixed-ability classrooms, provide students with universal curricular content, and differentiate instruction within the classroom to meet needs of all levels of students. The de-track system aligns with the federal government mandate to provide a high-quality education in the least restrictive environment. A de-tracking

system also aligns with NJDOE regulations to modify educational experiences in a way that meets needs of students in attaining proficiency levels in Common Core State Standards. De-track systems will help address teachers' needs to incorporate best practices of cooperative learning, real-life learning, student-centered tasks, and guided and independent practices. The use of best practices will satisfy the state regulation to use research-based practices and increase the probability that students will reach proficiency levels. The de-track system will infuse mathematical leaders into all classrooms addressing teachers' concerns about the need to use peer tutoring and small group instruction. The recommendation to move to a de-track system includes suggestions for providing teachers with professional development in mixed-ability teaching to counter consequences inherent to de-track systems that were presented in the literature.

Steps for Implementing a De-track System

Build a vision for equity in mathematics placement. Researchers found that implementation of a new policy requires teacher' commitment (Schlechty, 2009). Teachers at Oak Brook need to understand the purpose behind the policy change to a de-track system. Administrators will need to include teachers in the process of designing a de-tracked vision for the mathematics department to enhance the probability that teachers will commit to the new policy. The vision will need to be created, communicated, and understood by administrators, teachers, and parents. Oak Brook School should also provide opportunities for the school community to engage in discourse about assumptions related to student learning to address fixed-ability thinking. Teacher resistance,

confusion, and biased thinking could pose barriers when implementing a de-track system. Developing a vision, creating a unified community, and uncovering fixed-ability thinking will reduce the chance that barriers will impact the success of the de-track policy and will led the district to create a high-quality education and a least restricted environment.

Implement a Pilot Study. Oak Brook School should first institute a pilot study.

Curriculum, instruction, and assessment decisions should be data-driven (Love, 2009).

Oak Brook School should implement a pilot study to assess effectiveness of the de-track system in meeting needs of teachers, basic skills students, and other students, and in improving student performance on the NJ ASK. The school should pilot the de-track program with a portion of the sixth grade population for one school year. Pilot teachers should receive professional development in mixed-ability teaching, differentiated instruction, and culturally proficient classrooms before and during the pilot process to improve teacher capacity to teach in mixed-ability classrooms. Pilot teachers should work collaboratively to create research-based instructional lessons. The school should evaluate the effectiveness of the program using NJ ASK scores, LinkIt benchmark scores, and teacher questionnaires in order to make modifications and decisions about next steps.

Develop Evaluation Measures. The purpose in de-tracking students is to improve mathematics performance for sixth grade basic skills students by providing a more manageable classroom environment. Oak Brook School should use formative and summative standardized assessment measures to determine if the de-track policy improves student learning and implementation of best practices. Summative data from the NJ ASK administered before and after implementation will assist the school in

determining if the de-track classroom environment and new teaching strategies resulted in increased mathematics performance. Formative data from the quarterly LinkIt benchmark assessment will assist the school in determining how the de-track system affected student performance over time. The school can use formative data to make adjustments to the policy in response to challenges encountered during the implementation of the de-track system and new instructional practices.

Schools should validate data findings by using qualitative data. The use of a teacher questionnaire will provide the school with the opportunity to determine teachers' perceptions about effectiveness of the de-track policy in improving student performance and addressing barriers of the previous track system. Questions on the survey should be designed to uncover teachers' perceptions about how de-track environments:

- Help meet student' needs;
- Help to use best practices on a consistent bases;
- Effect student performance;
- Present successes and challenges in mathematics instruction.

The school personnel should use data from the questionnaire to modify the implementation of the de-track system and new instructional strategies in an effort to increase the chance of success for the new policy. Evaluating the implementation of a de-track system will help Oak Brook School personnel provide a high-quality education in a least restrictive environment based on student' needs and scholarly data.

Provide Professional Development Opportunities. Researchers identified consequences to de-track systems. Those consequences included teacher frustration in balancing needs and rigor, negative attitudes about school for high-attaining students due to behavior issues within the de-track classroom, increases in failure rates and unrealistic expectations students for low-attaining students, and decreases in grades for all students but low-attaining students. In order to prevent these negative consequences, teachers will need to build their capacity for teaching diverse students in mixed-ability environments. The district should provide teachers with professional development opportunities in mixed-ability teaching, differentiated instruction, and culturally responsive classrooms. The mixed-ability training should help teachers understand essential principles of mixed-ability classrooms. Differentiated instruction training should help teachers understand how to differentiate the content, process, product, and environment to meet individual needs without creating inequalities. Culturally responsive classroom training should help teachers address assumptions that lead to fixed-ability thinking. Incorporating professional development opportunities will help Oak Brook personnel provide a least restrictive environment for marginalized populations and high-quality education.

Full Implementation. Based on positive results from the pilot study, Oak Brook personnel should implement the de-track system to the entire sixth grade population in year two. The full implementation phase will follow the same procedures as the pilot study. The only addition to the full implementation plan is that Oak Brook personnel will create an aligned curriculum and will select a common textbook series to use in the de-track classroom environment, which will further help Oak Brook create a high-quality

education in the least restrictive environment. The school community will need to examine content contained in standards to create curriculum units. School personnel should also examine different textbooks to evaluate the alignment with the Common Core State Standards, challenge level of the material, and use of individualized instruction. If the pilot study does not demonstrate positive results, Oak Brook personnel should consider reducing the amount of track levels at the middle school as an alternate solution to the problem. During the interview process, teachers suggested that de-tracking the bottom two levels would improve the track environment by breaking up the amount of low-level students in one class, providing sparks from higher-functioning students, and allowing teachers to use differentiation and student-centered practices.

Conclusion

A portion of basic skills students underachieved on the NJ ASK consistently. Oak Brook teachers indicated that the current track system presented barriers to using research-based practices with basic skills students. Researchers found that track systems had a negative impact on performance, self-confidence, work habits, equality, and independence levels. Consequences associated with track systems interfered with Oak Brook School's ability to comply with government regulations to provide a high-quality education in a least restrictive environment and modify services to meet students' needs. De-track mathematics classrooms will address the issues surrounding track systems. The recommendations include developing a vision for equity, a pilot study, professional development, and curriculum alignment. The goal of the de-track policy is to increase opportunities for students to reach proficiency levels on the NJ ASK.

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Appendix I: Teacher Questionnaire: De-tracking Evaluation

1. On average, how often did you use cooperative learning activities in a given week?	0-1 times	2-3 times	4-5 times
2. On average, how often did you use alternative teaching designs in a given week?	0-1 time	2-3 times	4-5 times
3. On average, how often did you use real-life activities in a given week?	0-1 time	2-3 times	4-5 times
4. On average, how often did you use student-centered learning activities in a given week?	0-1 time	2-3 times	4-5 times
5. On average, how often did you use guided practice in a given week?	0-1 time	2-3 times	4-5 times
6. On average, how often did you use independent practice in a given week?	0-1 time	2-3 times	4-5 times
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7. Describe how the de-track climate is affecting student performance.			
8. Describe the successes you or your students have experienced in the de-tracked classroom.			
9. Describe the challenges you or your students have experienced in the de-tracked classroom.			

Appendix J: Curriculum Vitae

Christy Peters-DeFilippis**Education**

Ed.D. **Walden University, Minneapolis, MN.** Curriculum, Instruction, and Assessment.

Expected December 2014.

M.A. **Nova Southeastern University, Ft. Lauderdale, FL.** Teaching and Learning. August 2002.

B.A. **University of Maryland, College Park, MD.** Elementary Education with a concentration in Science. May 1993.

Teaching Experience

- Rowan University, Glassboro, NJ September 2013 – present
Instructor – Teaching in Learning Communities I & II
 Developed syllabus, created course structure, supervised field experience placements, and designed innovative lessons
[REDACTED] 2000 – 2013
[REDACTED]
 Planned differentiated lessons, developed civic responsibility, and promoted multiple intelligences
- Borough of Point Pleasant School District, Point Pleasant, NJ 1997 – 2000
Teacher, fourth grade, Ocean Road School
 Planned differentiated lessons in all subject areas
- Montgomery County Public School District, Rockville, MD 1994-1997
Teacher, fourth – fifth grades, Cresthaven Elementary School
 Developed real-life lessons in all subject areas

Publications/Presentations

- Mid Year BSI Mathematics Services Request Form 2012-2013
Designer, [REDACTED]

Developed a screening form for the entrance process into remedial mathematics supplementary courses

2005-2007

Presenter,

Developed and presented a Holocaust curriculum with unit lesson plans for third through sixth grade teachers

Research Experience

- Walden University, Minneapolis, MN

2013 – present

Researcher of a Project Study, “How Do a Select Group of Sixth Grade Teachers Describe How They Teach Mathematics to Basic Skills Students?”

Analyzed data, read current literature, designed a research study, completed the IRB process, and collected and analyzed data

Related Experience

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2010

Fundraiser Coordinator

Partnered with Aslan Youth Ministries to organize a student change drive, raised money to build a medical clinic in Haiti, and encouraged students to bring social change to marginalized cultures

1999, 2000, & 2005

Textbook Adoption Committee Member

Analyzed textbooks, adopted a new mathematics and social studies series, and developed an understanding of core content standards in mathematics and social studies

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2000 & 2006

Curriculum Alignment Committee

Aligned all curriculum to the New Jersey State Standards and created a desk top curriculum

- Borough of Point Pleasant School District 1998 - 2000
Project Soar Mathematics Teacher
 Supervised and planned instructional activities for at risk mathematics students and further developed the ability to differentiate instruction to meet individual students' instructional and emotional needs
- Montgomery County School District 1995 – 1997
Student Council Advisor
 Arranged meetings, held elections, supervised social and community projects and developed activities to encourage student civic awareness
- Montgomery County School District 1996
Science Fair Coordinator
 Designed guidelines, set timelines, coordinated judges, and encouraged experimental learning in the area of science

Professional Development

- Temple University, Philadelphia, PA January 2014
Faculty Conference in Teaching Excellence
 Guest speakers Michele DiPietro and Marsha Lovett presented research based principles for effective teaching
- Montclair State University, Montclair, NJ July 2011
Supervisor's Certificate Program
 Researched and analyzed key principles for effective administration and obtained Supervisor's certificate
- Rutgers University, New Brunswick, NJ 2009 – 2010
Rutgers Leadership Program
 Gained knowledge in the principles of administration and developed leadership skills
- ETS Praxis Series, New Jersey 2009
Praxis Middle School Mathematics Examine
 Passed the Praxis exam and obtained highly qualified status

Affiliations/Memberships

- National Council of Mathematics Teachers September 2013 – present
- ASCD September 2013 – present
- United States of America Track and Field New Jersey January 2000 – present

Interests

- Hope for Haiti 5K Run 2010 & 2011

Race Director

Organized a race to raise money for Aslan Youth Ministries and their efforts to build a medical clinic in Haiti. Responsibilities included obtaining permits, maintaining records, seeking sponsorship, promoting the race, and supervising race day activities.

- Team World Vision 2009

Running Coach, Philadelphia Marathon

Trained a group of 30 people to run a marathon to raise money for Team World Vision and their project to build wells in Zambia, Africa. Responsibilities included designing training schedules, organizing fundraising efforts, motivating runners, providing medical advice, and organizing race day details.