MATHEMATICS INSTRUCTION FOR MIDDLE SCHOOL STUDENTS WITH AND AT-RISK FOR BEHAVIORAL DISORDERS: A SURVEY STUDY

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The undersigned, appointed by the Dean of the Graduate School, have examined the dissertation entitled:

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Presented by Stacey Eagan Lefort Jones, a candidate for the degree of Doctor of Philosophy and hereby certify that in their opinion it is worthy of acceptance.

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This dissertation is dedicated to my husband, J. Michael Jones Jr., our two beautiful daughters, Teagan Elizabeth and Brynley Anne and my parents, Wayne and Marilyn Lefort. Mike, you have been a constant source of support throughout this academic journey. Your own drive and commitment to excellence continuously inspire me to be my best…and maybe inspire a little bit of competitiveness too! I could not have done this without you. Thank you for being my partner in crime in this sometimes crazy but wonderful life of ours. Teagan and Brynley, I love you both more than I ever though possible. I hope you grow to dream big and stop at nothing to achieve your goals, whatever they may be. And I hope my achievements also inspire you to push yourselves to your own limits. It is an honor to be your Mommy! Mom and Dad, thank you for letting me follow my own dreams and always believing in me...no matter how crazy my ideas. You are the greatest parents I could ask for. I am incredibly lucky and I love you all! XOXO

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ABSTRACT

This survey study was designed to investigate mathematics instruction for middle school students with and at-risk for emotional and behavioral disorders (EBD). It sought to identify who is teaching mathematics to students with and at-risk for EBD, investigate if mathematics and special education teachers are implementing recommended curricula and instructional practices and their perceived level of impact of these recommendations, and also determine if there are differences between mathematics and special educators. A questionnaire was developed and distributed to mathematics and special education teachers of grades 6-8 in Missouri. Responses were compared by teacher type. Results indicate that there are statistically significant differences between the teacher groups for some areas of curriculum and instructional practice usage. Generally, mathematics teachers are implementing curriculum recommendations more frequently than special educators. While special educators are implementing instructional practice recommendations more frequently compared to mathematics teachers. Yet, overall teachers are implementing curriculum recommendations and instructional practices and perceive these practices to have impact on the academic outcomes of students with and at-risk for EBD. Limitations and implications are discussed.

CHAPTER 1

INTRODUCTION AND REVIEW OF THE LITERATURE

Emotional/Behavioral Disorders and Academic Outcomes

Students with Emotional/Behavioral Disorders (EBD) by definition experience difficulties associated with internalizing and externalizing behavior patterns that disrupt their ability to make progress in social, behavioral, and academic domains of school (Lane, 2004; Mooney, Denny, & Gunter, 2004). As a result of these behavioral characteristics, students with EBD experience poor outcomes in school that are often followed by poor social and economic outcomes in adulthood (Mooney, et al., 2004). Students with EBD experience low grades, academic underachievement, high dropout rates, and grade retention (Bradley, Henderson, & Monfore, 2004; Landrum, Katsiyannis, & Archwamety, 2004; Landrum, Tankersley, & Kauffman, 2003; Wiley, Siperstein, Bountress, Forness, & Brigham, 2008). What is alarming is that they do so at rates higher than students in any other disability category (Nelson, Benner, Lane, & Smith, 2004; Trout, Nordness, Pierce, & Epstein, 2003).

Dropout rates for students with EBD have been estimated at approximately 50% (Landrum et al., 2004; Landrum et al., 2003). This is undoubtedly related to academic difficulties and failures these students experience in school (Nelson, et al., 2004). Students with EBD experience moderate to severe academic achievement deficits across all content areas (Lane, 2004; Nelson, et al., 2004; Reid, Gonzalez, Nordness, Trout, & Epstein, 2004; Trout et al., 2003; Wagner, Friend, Bursuck, Kutash, Duchnowski, Sumi, et al., 2006) regardless of economic status (Siperstein, Wiley, & Forness, 2011). Data from two national longitudinal studies of student with disabilities indicate more than three-quarters of students with EBD score in the bottom half of academic measures of reading and mathematics (Wagner et al., 2006; Wagner, Kutash, Duchnowski, Epstein, & Sumi, 2005; Wiley et al., 2008). Academic performance does not seem to improve overtime, in fact there is evidence suggesting that EBD student deficits in academic content, particularly mathematics, remain stable or worsen as they age (Lane, 2004; Mattison, Hooper, & Glassberg, 2002; Nelson, et al., 2004; Siperstein, Wiley, & Forness, 2011; Wagner et al., 2006). Poor academic outcomes of students with EBD and legislative actions have re-directed the needs and research interests of the field.

Historically, instruction and intervention for students with EBD has focused on improving social and behavioral outcomes (Lane, 2004; Sutherland, Lewis-Palmer, Stichter, & Morgan, 2008; Wiley et al., 2008). However, in recent years legislative changes have shifted the focus of special education to emphasize academic outcomes for students with disabilities. The No Child Left Behind Act (NCLB) of 2001 (P.L. 107-110) and the reauthorization of the Individuals with Disabilities Education Improvement Act (IDEA, 2004) have established mandates to target poor school outcomes for all students including those with EBD. Students with EBD are held to the same standards of progress in academics as their typically developing peers. As part of the NCLB and IDEA initiatives, students with disabilities must have access to the general curriculum, demonstrate “adequate yearly progress” in the academic subject areas of reading, writing, math, history, and science, and participate in standardized testing (Mooney, et al., 2004; Wagner et al., 2006). Additionally, the National Council for Teachers of Mathematics (NCTM; 2000) also recommends increased participation by students with disabilities in the NCTM Standards. One of the major tenants of NCLB is the implementation of scientifically based education programs. These reform mandates have increased interest in empirically validating academic interventions to improve outcomes for students with EBD (Bradley et al., 2004; Mooney et al., 2004; Wiley et al., 2008).

In the quest for establishing evidence based instructional practices to teach students with EBD academic content, meta-analyses and reviews of research literature have been conducted to evaluate the existing research on academic intervention and instruction. Reviews of the literature indicate that the majority of academic intervention research has focused on reading instruction with little attention to mathematics instruction for students with EBD (Lane, 2004; Mooney, Epstein, Reid, & Nelson, 2003; Pierce, Reid, & Epstein, 2004). In an investigation of academic intervention research trends from 1975 through 2002, Mooney et al. (2003) reported that of 87 studies of interventions for students with EBD only 27 included mathematics as part of the intervention. Lane (2004) conducted a review of research literature to identify studies of academic interventions for students with EBD and found of the 25 included studies published between 1990 and 2003, only 11 addressed mathematics instruction. These reports are problematic, given the importance of mathematical skills to success in adulthood (National Mathematics Advisory Panel, 2008).

Additional pressure to implement recommended practices has prompted research examining the practices teachers are utilizing for students with EBD and other learning disabilities. Maccini and Gagnon (2006) examined instructional practices and use of accommodations in assessment for secondary students with learning disabilities and EBD and found that the number of methods courses taken by teachers influenced the instruction and accommodation practices used. Jackson and Neel (2006) investigated whether elementary students with EBD have access to the curricula set forth by the NCTM and found that students in self-contained special education settings typically do not.

Because mathematic skills are believed to be crucial to positive outcomes for all students including those with EBD (Maccini & Gagnon, 2002; Templeton, Neel, & Blood, 2008), the ability to perform in mathematics is important not only because mathematics is involved in other content areas such as science and business curriculum but also because problem-solving and computational skills are essential to every day life (Hodge, Riccomini, Buford, & Herbst, 2006). Failure in mathematics may contribute to problems in adulthood such as maintaining personal finances or holding a job (Bottge, Rueda, & Skivington, 2006; Cheney & Bullis, 2004). Specifically, students with EBD have difficulty attaining and retaining the basic and computational mathematics skill sets that are vital to functioning in school and in life (Templeton et al., 2008; Wagner et al., 2006).

Statement of Problem and Purpose of Study

The current poor outcomes for students with EBD and the field of special education's emphasis on evidence-based instructional practices leads to the need for additional investigation of academic instruction in mathematics. Only in recent years has EBD research focused on mathematics instruction and the majority of research on teacher practices for students with EBD has focused on either elementary or secondary students (Gagnon & Maccini, 2007; Jackson & Neel, 2006; Maccini & Gagnon, 2002) leaving practices for middle school students unaddressed. Middle school students with learning difficulties, including EBD, are at risk for mathematics failure especially when they get to middle school because of the rigorous nature of the middle school curricula compared with elementary curricula (Montague & Jitendra, 2006). The current study aims to investigate mathematics curricula and instructional practices for middle school students with EBD in order to add to current research base.

Given the poor outcomes demonstrated by students with EBD in mathematics, the remainder of this chapter will examine evidence-based practice in mathematics instruction. First, recommended practices for mathematics instruction will be examined for all middle school mathematics instruction as well as recommended practices for middle school students struggling in mathematics, including those with challenging behavior, learning disabilities, and low achievement. Second, the literature on teacher instructional practices for students with EBD will be analyzed to establish what is currently known about mathematics instruction for students with and at-risk for EBD. A brief review of general instructional practice recommendations will be presented. Research focusing on instructional interventions for students with EBD will be discussed to note gaps in the existing research base. Finally, given the literature reviewed, a statement of purpose for research will made and research questions established.

Recommended Curriculum Standards and Instructional Practices

In recent years, several professional organizations have come forth with recommendations for instructional practices in mathematics. The National Council for Teachers of Mathematics (NCTM) is one organization that has established standards for mathematics instruction for grades K-12 (2000). The National Mathematics Advisory Panel, a nineteen-member panel established by former President Bush to review research on mathematics education, published a report in 2008 outlining the blueprint for advancing mathematics education in the United States. The What Works Clearinghouse has also established guidelines for recommended practices in assisting students struggling with mathematics as part of a practice guide for implementing response to intervention in mathematics for elementary and middle school students (Gersten et al., 2009). The purpose of this section is to review the recommendations established by the three aforementioned organizations in order to establish a framework for recommended practices in mathematics education.

NCTM Recommendations

As part of the Principles and Standards for School Mathematics (NCTM, 2000), the NCTM established six principles that they believe constitute a high-quality mathematics education. These principles include: (a) equity, (b) curriculum, (c) teaching, (d) learning, (e) assessment, and (f) technology. The "equity" principle establishes the need for high expectations and for all students to access and attain mathematical proficiency. This principle recognizes that differences in ability exist, but all students should be provided with instruction and opportunities to learn mathematics. The principle of "curriculum" highlights the need for coherent curricula that link and build on mathematical ideas to facilitate the development of a deeper understanding of mathematics (Bryant, Kim, Hartman, & Bryant, 2006; NCTM, 2000). Concepts and skills should be linked to "big ideas" and connect back to prior knowledge (Bryant et al., 2006). The "teaching" principle establishes the need for teachers to know what their students understand so that instruction can be planned accordingly (NCTM, 2000). Teachers should use information about effective instructional practices to guide the practices implemented in their classrooms. The notion of the "learning" principle is that students must not only learn mathematics but also learn with understanding. This principle addresses the need for students to understand and apply mathematical procedures, concepts and processes (Bryant et al., 2006). The fifth principle points out the value and need to use "assessment" to support learning and guide instructional decisions. The final principle is the "technology" principle that calls for the use of technological tools to support and enhance mathematical learning (NCTM). The principles provide an overarching framework for standards instruction to occur under. These principles apply to all students across all grade levels. The NCTM more recently established curriculum focal points (NCTM, 2006) that build on the content and process standards (NCTM, 2000).

The NCTM curriculum focal points highlight specific areas of mathematical proficiency that instructional curriculum should focus for each grade level (NCTM, 2006). The focal points for grades 6-8 address the areas of (a) number and operation, (b) algebra, (c) geometry, (d) measurement, and (e) data analysis (see Table 1). For students in grades 6 the curriculum should focus on the understanding of and fluency with multiplication and division of fractions and decimals, make connections between ratio, rate, multiplication and division, and use mathematical expressions and equations (NCTM, 2006). Grade 7 mathematics curricula should address application and understanding of proportionality, use and understanding of formulas for determining surface area and volume, the development of an understanding of mathematical operations on rational numbers, and solving linear equations (NCTM, 2006). The eighth grade curriculum focal points recommend focusing on analysis, representation and solving of linear equations and systems, analysis of two- and three-dimensional figures, and the summarizing and analysis of data sets. It is recommended that these be addressed in ways that promote the process standards of: (a) problem-solving, (b) reasoning and proof, (c) communication, (d) connections, and (e) representation (NCTM, 2000). The process standards provide the framework for building problem-solving skills and selecting and using reasoning and proof to develop and evaluated mathematical arguments. These process standards also address the need for students in grades 6-8 to be able to mathematically and verbally communicate mathematical thinking to others. They emphasize the ability to analyze and evaluate mathematical thinking and the importance of making connections among mathematical ideas (Bryant et al, 2006; NCTM, 2000). Finally, the processes standards highlight the need for student understanding in how to use various representations to model mathematics, solve problems, and communicate mathematical ideas.

Table 1

NCTM Standards for Middle School*

Curriculum Focal Point	
Number and operations	• Grade 6 o Understanding of/fluency with multiplication and division o Connection of ratio/rate to multiplication and division • Grade 7 o Understand and apply principles of proportionality o Understanding of operations on rational numbers o Solve linear equations • Grade 8 o Analyze and summarize data sets
Algebra	• Grade 6 o Use of mathematical expressions and

	equations (writing and interpreting) • Grade 7 o Understanding/application of proportionality o Formula use to determine area and volume o Understanding of operations on rational numbers o Solve linear equations • Grade 8 o Analyzing and representing linear functions o Solving linear equations/systems of linear equations o Analyze and summarize data sets
Geometry	• Grade 7 o Understanding/application of proportionality o Formula use to determine area and volume • Grade 8 o Analyze two and three-dimensional figures (and space) using distance and angles
Measurement	• Grade 8 o Analyze two and three-dimensional figures (and space) using distance and angles
Data analysis and probability	• Grade 7 o Make estimates relation to proportions o Use of theoretical probability and proportions to make predictions • Grade 8 o Analyze and summarize data sets
Process Standards	
Problem-solving	• Solve problems that arise in mathematics (or other content areas) • Build new mathematical knowledge through problem solving • Apply strategies to solve problems • Understand, monitor, and reflect on the process of problem-solving
Reasoning and proof	• Develop and evaluate mathematical proofs and arguments • Select and use various methods of reasoning and proof • Recognize reasoning/proof as essential to mathematics
Communication	• Communicate mathematical thinking clearly to others • Analyze mathematical thinking of others

Communication	• Communicate mathematical thinking clearly to others • Analyze mathematical thinking of others • Organize mathematical thinking and use the language of mathematics to express ideas
Connections	• Recognize and use connections among mathematical ideas • Apply mathematics in contexts outside mathematics • Understand how mathematics ideas connect and build on one another

* Adapted from Montague & Jitendra (2006) and NCTM (2000; 2006)

Most states have aligned their individual curriculum standards to the NCTM Curriculum Focal Points (Bryant et al., 2006; Jackson & Neel, 2006; Maccini, Strickland, Gagnon, & Malmgren, 2008). With legislation such as NCLB and IDEA setting forth requirements that all students have access to grade-appropriate curricula, standards have become even more critical to mathematics educational practices, especially for students with and at-risk for disabilities such as EBD (Maccini et al.; Mooney et al., 2004). A major piece of these legislative mandates is the use of empirically validated instructional practices (Maccini et al.). The National Mathematics Advisory Panel and What Works Clearinghouse have established recommended practices based on reviews of empirical research.

National Mathematics Advisory Panel Recommendations

President George W. Bush established the National Mathematics Advisory Panel (NMAP, 2008) in 2006 and charged the panel to review scientific research in order to provide advice on improving mathematics education in United States. The panel placed a great deal of emphasis on preparing students for algebra. After reviewing more than 16,000 research publications, hearing testimony from 110 individuals with expertise in particular areas of mathematics education, reviewing commentary from 160 organizations and analyzing results of a survey given to 743 algebra teachers, the panel integrated major findings and published their final report (NMAP, 2008). The final report presents the main findings and recommendations based on the panel's review of literature and expert testimony. Recommendations were made by the NMAP in several areas including (a) curricular content, (b) learning processes, (c) teachers and teacher education, and (d) instructional practices. A central point across all of the panel's recommendations was the need to make use of high-quality empirical evidence and rigorous research about how children learn when determining best practices in mathematics education (NMAP, 2008). Specific recommendations from the report pertaining to math education for middle school students with and at-risk for EBD are discussed below.

Curricular content. The NMAP's curricular content recommendations are made based on the critical need for students to understand the foundations and major topics in algebra to obtain mathematical proficiency (2008). Based on these needs, the panel proposed three clusters of concepts and skills deemed critical foundations of algebra. These are the concepts and skills that are most essential to attain prior to moving into algebra curricula. The first is the need for children to acquire fluency with numbers by the fifth or sixth grade. Students should have an understanding of whole numbers, place value, decomposition and composition of numbers, basic operations of addition, subtraction, multiplication, and division, and the ability to use the commutative, associative, and distributive properties. Students at this point should have a developed automaticity or fluency in basic facts relating to addition, subtraction, multiplication and division and they should be able to apply this knowledge to mathematical problem solving.

The second cluster identified is developing a thorough understanding of fractions (NMAP, 2008). This includes fluency in both positive and negative fractions. Prior to algebra coursework, middle school students should understand how and why sums, differences, products, quotients and decimal numbers can also be represented as fractions and how to carry out operations with efficiency and confidence. The panel recommends that particular focus be given to the instruction of fractions given that this seems to be the least developed area of pre-algebra for mathematics students in the U.S. (NMAP, 2008).

The third cluster that warrants curricular attention prior to algebra coursework is to have an understanding of aspects of geometry and measurement (NMAP, 2008). By the middle grades, students should have experience and understanding with similar triangles (triangles of like shapes), as this is directly relevant to the study of algebra (NMAP, 2008). Students should be able to analyze two- and three-dimensional shapes using formulas for area, surface area, perimeter, and volume. Students should also be able to find unknown angles, lengths and areas.

Within recommendations pertaining to the three critical foundations of algebra, the NMAP has also established benchmarks (2008). Examples of these benchmarks include (a) by the end of grade 5 students should be proficient with the addition and subtraction of whole numbers, (b) by the end of grade 7 students should be proficient with all operations involving positive and negative fractions, and (c) by the end of grade 6, student should be able to analyze the properties of two-dimensional shapes and solve problems involving perimeter and area (NMAP, 2008, p. 20). These benchmarks have been specified by the panel to guide classroom instruction, curricula development, and state assessments.

The overall recommendation for curriculum development for students in elementary and middle school grades is the need for a focused (inclusive of the most important topics underlying algebra) and coherent (logical) progression of mathematics instruction and learning where proficiency is emphasized. Proficiency is defined by the NMAP using the same attributes the National Research Council (NRC) established in their text *Adding It Up* (NMAP, 2008; NRC, 2001). The five attributes associated with proficiency are: (a) conceptual understanding, (b) procedural fluency, (c) strategic competence, (d) adaptive reasoning, and (e) productive disposition (NRC, 2001). In essence, the panel recommends a focus on these five areas that are essential to developing mathematical proficiency within a curriculum that emphasizes algebraic preparedness.

Learning processes. Beyond the recommendation for developing algebra-focused curriculum, the panel also made recommendations based on research that examines the processes in which students learn and acquire mathematics skills. The NMAP (2008) placed an emphasis on the importance of early intervention and instruction given the importance of early mathematical knowledge for long-term academic success. Within the recommendations based on learning processes, the panel also highlights the need for students to develop computational proficiency and conceptual understanding of numbers and mathematical concepts. Additionally, the panel reiterates the importance of understanding fractions, geometry and measurement. The panel recommends that sufficient time be devoted to the acquisition of conceptual and procedural knowledge about fractions with curriculum that provides opportunities to use a variety of representations and explicit connections to ensure students truly gain understanding of fractions. Estimation and magnitude should also be a focus of curriculum but additional research is needed regarding the best practices for teaching estimation of magnitude. Beyond the focus on curricular materials and learning processes is the central component of teachers both with respect to teacher preparation and training as well as the major importance of teacher instruction and classroom practices.

Teachers and teacher training. The NMAP (2008) task group on teachers reviewed research literature demonstrating that differences in mathematics achievement are often attributed to differences in teachers and the effects of teachers on student achievement is compounded if a student has a series of either effective or ineffective teachers. These findings emphasize the critical need to have knowledgeable highly qualified teachers instructing mathematics. Based on the research reviewed, the panel recommends teachers know the mathematics content they are teaching and the connections to other important areas of mathematics, both prior to and beyond the level they are teaching and as part of teacher training they should be given opportunities to learn mathematics for teaching as there is a relationship between teacher content knowledge and student achievement. The panel also recommends emphasis on content knowledge as part of pre-service preparation, early career mentoring and professional development. While the knowledge and training of teachers plays an important role in mathematics education what ultimately makes a difference is the actual mathematics instruction students are provided.

Instructional practices. The NMAP (2008) makes several recommendations regarding what instructional practices should be implemented in classrooms, the first being that instruction should follow a balanced approach between teacher-centered and student-centered instruction. There is no evidence that supports the use of only one of these approaches. The panel notes the promising evidence base for practices such as peer tutoring and some structured forms of cooperative learning. Other instructional practices the panel recommends are the use of real-world problems and using technologies that have been shown to be effective to enhance mathematics instruction. The research base for using real-world contexts when instructing students in mathematics is limited but it does suggest that the use of these types of problems has a positive impact on some types of problem solving. The panel notes that the evidence base is not strong enough for widespread policy recommendations but future research is necessary given the positive outcomes that have been demonstrated. The use of technology as a potentially useful tool for computer drill and practice that aides in developing automaticity and providing tutorials that introduce and teach specific mathematics subject manner is also recommended.

The panel report recommends the ongoing use of formative assessment as a tool to monitor student learning as research results indicate benefits for all students with its use. The panel also recommends that teachers be trained in and provided guidance in the use of formative assessment to guide instructional decision making, especially for students struggling in mathematics. Finally, the panel report makes specific recommendations for students with learning disabilities and those that are low achieving.

Instructional practices for low achieving students and students with learning disabilities. The first panel report recommendation specific to students with disabilities and those that are low achieving is that these students should receive explicit systematic instruction on a regular basis that allows for student to ask and answer questions and think aloud about problem-solving decisions (NMAP, 2008). The panel describes explicit systematic instruction as carefully sequenced instruction involving teacher explanation and demonstration of specific strategies and allowing student opportunities to ask questions and process usage of problem-solving strategies out loud while providing feedback to students. The panel notes that this type of instruction should not be the only instruction students with or at-risk for disabilities receive but explicit instruction does seem to be essential to building proficiency in computation and problem-solving (NMAP, 2008). The panel also recommends that time be dedicated to developing quick retrieval of basic mathematics facts, including instruction in strategies that would aide in increasing retrieval skills. Another instructional approach that the panel recommends for students with learning disabilities and low achievement is the use of visual representation, visualization, and concrete-representational-abstract (CRA). Given that mathematics involves use of representation and many of its ideas are metaphorical, the use of multiple representations allows for mathematical ideas to be expressed (NMAP, 2008). For students with learning disabilities, the use of visual representation has demonstrated effective outcomes such as increased understanding of mathematical concepts, improvements in computation, and increased problem-solving ability. The panel also recommends the use of strategies and instructional methods that encourage students to think aloud when processing mathematical problems. It is believed that when students are encouraged to verbalize about the strategies they are using it reduces the likelihood of rushing and recklessly responding to questions and problems (NMAP, 2008). Research on instruction in retrieval, visual representation and the use of think aloud practices have followed an explicit format and the panel recommends the use of explicit instruction when instructing students with learning disabilities and those with low achievement. The last general recommendation for teaching students with disabilities and learning problems is that time should be dedicated to foundational skills and conceptual knowledge necessary for students to understand grade level mathematics. Students must obtain certain benchmark skills to participate fully in the general education curriculum of their same grade peers, instruction should focus on ensuring that students with disabilities and those who struggle with mathematics continue to receive instruction in these foundational benchmark skills.

The final report of the National Mathematics Advisory Panel provides guidelines for recommended practices and approaches to educating students in mathematics. Some of the recommendations provide a framework for developing curriculum and preparing teachers while others are practices that have demonstrated positive outcomes for students and should be implemented in classrooms, including classrooms containing students with or at-risk for disabilities. These recommendations should have implications for how students are educated in mathematics.

What Works Clearinghouse IES Practice Guide Recommendations

Another source of recommended practices is the What Works Clearinghouse (WWC). WWC is a division of the Institute of Education Sciences (IES) set up to disseminate information about educational best practices based on scientific evidence and expertise. In April of 2009, WWC published a practice guide aimed at teachers working with students who struggle with mathematics in elementary and middle school grades (Gersten et al., 2009). This practice guide provides recommendations for mathematics education as part of a Response to Intervention model (RtI). However, the practices recommended are not all exclusive to RtI and should be implemented in all classrooms as best practices. The following section highlights four of the practice guide's recommendations relative to students struggling with mathematics, including students with or at-risk for disabilities such as EBD.

This IES practice guide makes two recommendations with strong evidence; the first of these recommendations is the use of explicit and systematic instruction (Gersten et al., 2009). Explicit and systematic instruction is defined in the practice guide as providing teacher demonstration, guided practice, corrective feedback and allowing student verbalization. The practice guide also highlights the NMAP (2008) definition of explicit instruction. Gersten et al. (2009) provide suggestions for how this practice should be carried out in classrooms. Suggestions for implementing explicit instruction for students struggling in mathematics are a result of empirical research and include: (a) providing clear teacher models with teacher "think-alouds", (b) providing opportunities for student to communicate problem-solving strategies, (c) using groupings for students to solve problems, (d) giving specific feedback clarifying what students have done correctly as well as what they can improve on, and (e) utilizing cumulative review following each session to ensure knowledge is maintained (Darch, Carnine, & Gersten, 1984; Fuchs, Fuchs, Prentice et al., 2003; Gersten et al., 2009; Jitendra et al., 1998; Tournaki, 2003).

The other recommendation based on a strong evidence base is teaching underlying structures as part of word-problem solving instruction and intervention (Gersten et al., 2009). Typically, students who struggle with mathematics demonstrate serious difficulty solving word problems relating to the concepts and operations they are learning (Geary, 2003). This practice guide makes recommendations stemming from the NMAP's (2008) recommendation to use explicit instruction to teach word problem solving. Instructing students in the structure of word problems, how to discriminate between various types of word problems and how to determine what information is relevant and what is superficial has demonstrated effective outcomes in several randomized control trials (Fuchs, Fuchs, Finelli, et al., 2004; Fuchs, Fuchs, Prentice, et al., 2004; Jitendra, Griffin, McGoey, et al., 1998; Xin, Jitendra, & Deatline-Buchman, 2005). Implementation of this recommendation should focus on teaching students about the various word problem types (e.g. change, compare) and teaching students to recognize the structural characteristics that exist in both familiar and unfamiliar word problem types (Gersten et al., 2009).

The IES practice guide also makes two recommendations that are based on moderate evidence. Moderate evidence, as defined by the WWC, includes research that displays moderate levels of either internal or external validity, uses non-control research design, or small sample sizes limiting the generalizablity of outcomes (Gersten et al., 2009). The two practices recommended with moderate levels of evidence to support them are the use of visual representations in instruction and intervention and allocated time devoted to build fluent retrieval of basic facts for students who struggle with mathematics.

The systematic use of visual representation and manipulatives have demonstrated positive results in improving achievement in operations, general mathematics concepts, pre-algebra concepts, and word problems (Darch, Carnine, & Gersten, 1984; Fuchs et al., 2005; Witzel, Mercer, & Miller, 2003; Woodward, 2006). The practice guide recommends the use of visual representations such as number lines, arrays, strip diagrams, and drawings to link abstract concepts with these representations. If visual representation is not enough, Gersten and colleagues recommend using concrete manipulatives (2009).

Establishing regular time for building fluent retrieval of basic facts is the other recommendation (Gersten et al., 2009). Fluency, quick retrieval of arithmetic facts, is a critical component to success in mathematics and lacking this skill may lead to difficulty mastering more complex mathematical concepts (Gersten et al., 2009; Woodward, 2006). Unfortunately, research has found that students who struggle with mathematics often lack fluency in basic mathematical facts (Geary, 2004). The IES practice guide recommends 5-10 minute intervention sessions for students who are struggling with mathematics. Using tools such as flashcards to build quick retrieval is one recommendation made in the practice guide. Additionally, the IES practice guide recommends the use of explicit instruction to teach students efficient counting strategies in kindergarten through grade 2 and to instruct the use of mathematical properties (i.e. associative, commutative) in grades 2 through 8 to determine facts and solve problems in ones head (Gersten et al., 2009). The four practices recommended by the IES practice guide are intended for all students including those with and at-risk for EBD who are struggling to learn mathematics.

Special Education Teacher Use of Recommended Strategies for Students with and at-risk for EBD

While researchers and experts in the field of special education have made recommendations for instructional practices for students with disabilities, the most crucial piece of educating students with EBD in mathematics may be the state of instruction, and what practices are currently occurring in the instruction of students with behavioral challenges. Several research studies have examined teacher practices for instructing EBD students in mathematics (Gagnon & Maccini, 2007; Jackson & Neel, 2006; Maccini & Gagnon, 2002, 2006; van Garderen, 2008). The current research base mainly focuses on secondary and elementary practices, with little emphasis specific to the middle school years. Two studies focused on teacher practices for middle school students with disabilities (Maccini & Gagnon, 2002; van Garderen, 2008). However, the examination of practices being implemented with elementary and high school students provides perspective regarding "what" teachers are doing, or should be doing, with students. The remainder of this section reviews research to date on teacher practices and perceptions relating to educational standards and general education curriculum.

Teacher instructional practices for students with EBD have been examined for both special education teachers and general education mathematics teachers (Gagnon & Maccini, 2007; Jackson & Neel, 2006; Maccini & Gagnon, 2002, 2006). Results from teacher survey research have yielded several important findings. First, teachers of special education reported being better prepared to teach mathematics to students with EBD than general education teachers, however, general education teachers reported being more prepared to teach the mathematics content (Gagnon & Maccini, 2007; Maccini &

Gagnon, 2002). This finding is not surprising given the emphasis on teaching mathematics to students with disabilities for special educators, opposed to the mathematics content emphasis for general educators (Maccini & Gagnon, 2002).

Maccini and Gagnon (2002) investigated differences in teacher perceptions of the NCTM standards by general and special educators. General educators reported knowing about the goals of the NCTM at a higher rate (95%) than special educators (55%) (Maccini & Gagnon, 2002). Additionally, the general educators also felt more confident in their ability to provide instruction in line with the NCTM standards. Given that the NCTM standards were revised and re-released in 2000, it is unknown if rates of familiarity have improved given the elapsed time and increased emphasis on standards based instruction for both general and special educators in the past eight years.

More recently, Jackson and Neel (2006) conducted a descriptive observation study examining the extent to which elementary students with EBD have access to NCTM standards based curricula across general and special education settings. The study specifically explored the differences between algorithm instruction and concept instruction in general and special education as well as the types of instructional practices implemented in these settings. Students in general education were more likely to have access to concept instruction (61%), a NCTM standard based practice, than students in special education (18% - 19%) who were more likely to receive traditionally algorithm instruction (74% vs. 30% in general education). The instructional activities also differed by setting. Student with EBD receiving mathematics instruction in general education were more likely to experience small group instructional activities (2 or more students, e.g. peer tutoring) than students in special education settings, who were more likely to be instructed in large group formats. This is problematic given the research base demonstrating positive academic outcomes for students with peer tutoring practices (Gersten et al., 2009). Instructional approaches were more balanced across general education settings, where students experienced a variety of instructional activities (Jackson & Neel, 2006). Jackson and Neel's findings should be interpreted with caution given the small sample size (12 classrooms in 4 schools), however, they do highlight some potential issues with instruction in special education settings.

Instructional activities and practices have also been examined for secondary students with EBD and learning disabilities (Gagnon & Maccini, 2007). Results of this study, investigating teacher use of validated and standards based instructional practices, indicated that general education teachers were more likely than special educators to use visual representations or graphics as part of graduated instruction or CSA (concrete, semi-concrete, abstract) and instruct students in the use of graphing calculators to facilitate learning. Special educators reported use of direct instruction techniques, including feedback and reinforcement and criterion mastery as an indictor of when to move to the next level at significantly different rates than general educators. Additionally, special education teachers were more likely to use self-monitoring strategy instruction relating to problem solving than general education mathematics teachers.

The same researchers conducted an investigation of instructional practices and assessment accommodations by secondary mathematics and special education teachers (Maccini & Gagnon, 2006). The types of instructional practices investigated included: (a) individualization, (b) additional practice, (c) reduced problems, (d) peer or cross-age tutoring, (e) manipulatives/concrete objects, (f) graphic organizers, and (g) strategy cue cards. This study yielded findings related to the types of instructional practices used when teaching basic mathematic skills and computation tasks verses multi-step problem solving tasks (Maccini & Gagnon, 2006). Special education teachers used a statistically significant greater number of instructional strategies to teach basic math skills than general education teachers. General educators utilized slightly more instructional practices to teach multi-step problem solving than special educators but the differences were not statistically significant. Overall, special educators were more likely than general educators to implement the use of accommodations, including assessment accommodations.

The research literature investigating instructional practices for students with EBD is limited but highlights the differences in practices for general education and special education settings for elementary and secondary students. The existing research base draws attention to the gap in research specifically examining middle school teachers' instructional practices for students with and at-risk for EBD. While teacher practices contribute perhaps the most crucial component that influences students with or at-risk for EBD, it is also necessary to review practices that have been empirically studied. The following sections will examine the instruction and intervention practices that have been examined and recommended specifically for students with EBD.

General Instructional Recommendations for Students with EBD

The literature highlights several general practice recommendations for teachers instructing students with and at-risk for EBD (Conroy, Sutherland, Snyder, & Marsh, 2008; Lewis et al., 2004; Vannest, Temple-Harvey, & Mason, 2008; Yell, 2009). This section will briefly review some of the general recommendations for instruction of students with EBD that should be implemented when instructing mathematics to these students.

Yell (2009) highlights several principles for the instruction of students with and at-risk for EBD including maximizing time on task and academic engagement. The amount of time students spend engaged, the more they will learn. Engagement can be increased by managing time efficiently, maintaining good classroom management so that the overall focus can remain on academic instruction rather than discipline, planning lessons that require participation and student response to the instruction for at least 80% of time, and the use of reinforcement (Yell, 2009).

The use of praise and reinforcement is considered a research-supported practice (Lewis et al., 2004) and has demonstrated effective outcomes in keeping students engaged in on-task behavior during academic instruction (Conroy, et al., 2008; Sutherland, 2000). Ideally, this would be used as part of a larger system of positive behavior support where reinforcement is provided for both academically and socially appropriate behavior. Praise should be used contingently in response to the desired answer or behavior (Conroy et al., 2008; Sutherland, 2000). Praise should also be specific to the target behavior or response (Sutherland, 2000).

Providing students with ample opportunities to respond (OTR) is another instructional practice that is recommended for teachers of students with or at-risk for EBD (Conroy et al., 2008; Lewis et al., 2004; Stichter, Lewis, Whittaker, et al., 2009; Yell, 2008; Vannest et al., 2008). Increasing the number of opportunities students have to correctly respond during academic instruction is associated with increases in academic achievement (Lewis et al., 2004; Yell, 2009) as well as decreases in inappropriate behaviors (Lewis et al., 2004). Students who are provided with opportunities to respond, answer and participate in instruction are also more likely to be engaged and learning (Yell, 2009). However, it should be noted that using OTR as part of high quality instruction requires that the instruction be appropriately matched to the students ability and the students responses need to be correct (Lewis et al., 2004; Templeton, Neel, & Blood, 2008; Yell, 2009). Problem behavior and academic failure of students with and at-risk for EBD is often a result of a disconnect between achievement or current levels of performance and the demand of instruction (Templeton, Neel, & Blood, 2008). OTRs can follow many types and characteristics. They may be verbal, individual, choral, and visual, among others, and involve a teacher prompt or cue and student response (Conroy, et al., 2008).

The use of explicit instruction is also recommended for students with and at-risk for EBD (Yell, 2009). The same components that have been recommended by the National Mathematics Advisory Panel and the IES practice guide are also presented as recommendations in the EBD literature. These components include: teacher presentation, guided practice, and corrective feedback (Yell, 2009). Additional recommendations include the use of scripted, Direct Instruction, instructional format and progress monitoring (Conroy, et al., 2009; Vannest, et al., 2009; Yell, 2009). Direct instruction (DI) is characterized by: instructional grouping, active engagement, a scripted presentation, and ongoing and continuous assessment (Yell, 2009). The scripted nature of DI features quick pacing, choral responding, corrective feedback, and guided and independent practice. Progress monitoring is the formative evaluation of student performance over time, typically with curriculum based measures or assessments to determine if and when mastery has been met for particular skills (Conroy et al., 2008; Yell, 2009).

The above general recommendations for instruction of students with and at-risk for EBD are not specific to mathematics, but rather good instructional methods and techniques that are supported by research and cut across various subject mattter. There are specific instructional interventions in the research literature that have been examined specifically for teaching mathematics to students with and at-risk for EBD. The following section will review this literature.

Mathematics Instructional Practices and Interventions for Students with EBD

In recent years, researchers have conducted meta-analyses and reviews of the research literature specific to academic instruction and intervention for students with EBD (Hodge et al., 2006; Lane, 2004; Mooney et al., 2003; Templeton et al., 2008; Trout et al., 2003). Mathematics interventions have demonstrated overall positive academic outcomes for students with EBD (Hodge et al., 2006; Pierce et al., 2004). While promising, the literature is very limited and only a few studies have been conducted to date (Hodge et al., 2006; Templeton et al., 2008). But given the deficits students with EBD exhibit in mathematics, it is critical to identify instructional practices that help students succeed (Maccini & Gagnon, 2002).

Of the research focused on academic interventions in mathematics for students with EBD, four main types have been examined: (a) student-mediated, (b) teacher-mediated, (c) peer-mediated, and (d) those facilitated by technology (Hodge et al., 2006; Mooney et al., 2004). Student-mediated interventions focus on self-management or self-monitoring. The student is taught procedures for observing, monitoring and documenting their behavior or academic performance (Landrum et al., 2003). Strategy instruction is another type of student-mediated intervention. Teacher-mediated interventions use the teacher as the facilitator and may include direct or explicit instruction, token economies, or manipulation of task difficulty (Pierce et al., 2004). Peer-mediated instruction includes peer-tutoring conditions including classwide peer tutoring (Landrum et al., 2003). The last main area is intervention that uses technology as a key part of the intervention. Typically this involves computer programs or videos that are anchored to the mathematics curriculum (Bottge, et al., 2006).

Student-Mediated Intervention

Interventions that use systematic instruction to teach students to act strategically and purposefully to improve outcomes, behavioral or academic, fall under the category of student-mediated intervention (Landrum et al., 2003; Mooney et al., 2004). These include self-monitoring or self-management but also include instruction in strategy usage. Studies of self-management and self-monitoring related to mathematics typically focus on behavioral outcomes as the primary dependent variable with mathematics performance serving as a secondary variable. For example, Levendoski and Cartledge (2000) instructed students to monitor on/off-task behavior using a checklist during independent work on newly taught mathematics material. Outcomes indicated when students used the self-monitoring checklist their on-task behavior and percentage of problems completed with accuracy improved compared with baseline conditions. Carr and Punzo (1993) examined the effects of self-monitoring academic work on the accuracy and productivity of student work across reading, spelling and mathematics assignments. The intervention demonstrated improvements in both accuracy and productivity on arithmetic operations worksheets. In a similar study, Lazarus (1993) instructed students to self-monitor accuracy of math worksheets. Results indicated improvements in percentage of accuracy on mathematics scores.

Most recently, Mulcahy and Krezmien (2009) examined contextualized instruction for middle school students with EBD using an area and perimeter instructional package that included self-monitoring of both behavioral and academic progress. Accuracy on probes improved for all students involved and students reported the self-monitoring assisted them to solve perimeter and area problems but not all students were able to maintain or transfer skills. Though promising, the evidence for self-monitoring to improve mathematics is limited (Money, Ryan, Uhing, Reid, & Epstein, 2005). It may be an effective intervention for students to improve accuracy on previously learned material but it is likely not an effective method to improve skills students are unable to do independently (Hodge et al., 2006).

Another type of student-mediated intervention that has demonstrated positive effects for students with EBD is the use of strategy training. Strategies are the steps and methods used when planning, performing and evaluating performance on tasks (Hodge et al., 2006). The evidence of strategy used for students with EBD is limited but promising. Davis and Hijaicek (1985) examined rate of accuracy and attention to task following two phases of instruction; teaching of strategy and instruction in self-talk. Results indicated that using self-talk in conjunction with a strategy to help solve two digit multiplication computation problems was effective in increasing both accuracy and attention to task behaviors. The combination of direct instruction and speaking out loud were more effective than direct instruction alone.

When students were assessed in strategy preferences based on structural analysis techniques, academic performance on mathematic probes increased (Jolivette, Wehby, & Hirsch, 1999). Students were presented with choices of strategies (antecedents) and when given opportunities to select a preferred strategy, academic outcomes improved. Assessment of what strategy is the most effective based on individual student strengths and difficulties is one possible method to improve mathematics instruction and outcomes for students with EBD but may not be feasible on a larger scale.

The use of mnemonics has also been evaluated for students with EBD. Cade and Gunter (2002) examined the effects of teaching student with EBD a musical mnemonic to aid in solving basic division problems. Students were taught to use finger tapping and a song to represent products and factors of the number seven. Student performance on percentage of division problems involving the number seven improved. The outcomes of this study are promising but this is the only known study of its kind and further research is necessary.

One final area of strategy instruction that has been examined for students with EBD is the use of the Cover, Copy, and Compare (CCC) model. CCC is considered an evidence based practice for improving reading outcomes but researchers have also demonstrated effective outcomes for mathematics performance for students with EBD (Cieslar, McLaughlin, & Derby, 2008; Skinner, Bamberg, Smith & Powell, 1993; Skinner, Ford & Yonker, 1991). CCC involves examining a model problem, copying the model problem, covering the modeled/copied problems and completing the problem without the model/copied assistance. The student then evaluates his or her performance. Students in the three studies (Cieslar et al., Skinner et al., 1993; Skinner et al., 1991) demonstrated improved accuracy in calculation of fraction problems, division problems, and multiplication problems, respectively. CCC is the only strategy intervention with replicated evidence (Hodge et al., 2006). In general, student-mediated interventions such as self-monitoring have demonstrated effective outcomes for students with EBD and are considered a recommended practice (Lewis, Hudson, Richter, & Johnson, 2004). But the research is limited with respect to mathematics and student-mediated intervention and instruction should be approached with caution.

Teacher-Mediated Intervention

Research has demonstrated that academic achievement is directly related to the proportion of instructional time that students are engaged in learning. Direct and explicit instruction lead by teachers is one method that has demonstrated effective outcomes for students with EBD. For example, Lee, Sugai, and Horner (1999) examined the effects of explicit instruction of difficult mathematics tasks on the academic and on-task performance of two students with EBD. Outcomes demonstrated improvements in on-task behavior both during individual instruction and following independent work once skills had been taught. The use of direct instruction, that includes structure, appropriate pacing, opportunities for guided practice, corrective feedback and practice of new skills, is a promising method for instructing EBD students in mathematics (Hodge et al., 2006). While this is the only study that has strictly focused on direct instruction of mathematics for students with EBD, direct explicit instruction is a recommended practice for students with EBD across all content areas.

Teacher-mediated instruction research also includes the manipulation of task difficulty to impact academic performance and on-task behavior. Skinner, Hurst, Teeple, and Meadows (2002) and Gilbertson, Duhon, Witt, and Dufrene (2008) both investigated the impact of adjusting the difficulty of tasks to increase on-task engagement and percentage of accuracy on mathematics assessment performance. Both studies reported that when students are given interspersed problems that are less challenging mixed in with challenging problems, rates of on-task behavior, academic responding, and problem solving accuracy increase (Gilbertson et al.; Skinner et al., 2002). These studies highlight the importance of instruction using ability appropriate materials as not to create frustration or task avoidance for students with EBD.

One other teacher-mediated intervention that has been examined is the use of token economies to increase mathematics accuracy (Swain & McLaughlin, 1998). Token economies are a type of reinforcement program that are often used in conjunction with positive behavior support programs. The use of reinforcement and positive behavior support are considered recommended practices for students with EBD (Lewis et al., 2004). Swain and McLaughlin (1998) specifically looked at how the use of a token economy impacted the performance on mathematics assignments for middle school students with EBD. Outcomes from this study indicated that the token economy reinforcement program demonstrated increased accuracy on mathematics assessments for students with EBD. Mong, Johnson, and Mong (2011) examined behavior and academic performance for students using a Check-in/Checkout reinforcement/feedback system for at-risk elementary students during mathematics instruction. Outcomes indicated improvement in both directly observed problem behavior and academic performance on addition and subtraction tasks. Results from all teacher-mediated intervention research, while limited, seem to demonstrate the positive impact teachers can have on mathematics performance by manipulating instructional components, level of task difficulty, or reinforcement procedures (Hodge et al., 2006). In a review of teacher-mediated interventions, Pierce, Reid, and Epstein (2004) concluded that while positive outcomes have been observed for these types of interventions, additional research is necessary.

Peer-Mediated Intervention

Instructional and intervention programs where students implement instruction for their peers have also demonstrated improved academic outcomes for students with EBD in mathematics (Mooney et al., 2004; Ryan et al., 2004). Peer-tutoring typically utilizes pairs or small groups of students engaged in cooperative learning that may emphasize instruction, error correction, and reinforcement of curricular materials by peers (Hodge et al., 2006; Ryan et al.). Early study of classwide peer tutoring for students with EBD demonstrated improvements in their computational skills (Franca, Kerr, Reitz, & Lambert, 1990). Recently the research in peer tutoring for students with EBD has not focused on mathematics despite early successful research and the most recent investigation that involved students with EBD was Harper, Mallette, Maheady, Bentley, and Moore's (1995) study of classwide peer tutoring where only one of eight students with disabilities was identified as having an EBD. The one student with EBD did demonstrate improvements in mathematics calculation. Unfortunately, the inclusion of only one student with EBD does not allow for generalizablity. It should be noted that students with EBD have demonstrated successful outcomes in other academic areas when classwide peer tutoring has been implemented (Hodge et al., 2006; Spencer, 2006; Spencer, Simpson, & Oatis, 2009).

Technology-Based Intervention

The final research focus includes the use of technology, such as computers or video models, to increase mathematics outcomes for students with EBD. Computer assisted instruction (CAI) and the use of technology in education is believed to be effective because it provides individualized instruction with immediate feedback and reinforcement (Bottge, Heinrichs, Mehta, & Hung, 2002; Bottge, Rueda, & Skivington, 2006; Hodge et al., 2006). Despite the assumed built in reinforcement of technology, early research that compared paper and pencil tasks to computer based drill and practice found that students met mastery criteria three times earlier with paper and pencil drills that students preferred (Landeen & Adams, 1998). Positive outcomes have been demonstrated in more recent research but not without limitations. Bottge and colleagues (Bottge et al., 2002; Bottge et al., 2006) have examined CAI for student with disabilities, including students with EBD, and have demonstrated some success. In a study of CAI for students attending a self-contained alternative school for students with or at-risk for EBD, adolescents with EBD demonstrated achievement growth on curriculum-aligned problem solving tests (Bottge et al., 2006). The students did not improve in standardized measure scores so there are limitations to the generalizablity of the skill acquisition and growth. Billingsley and colleagues (Billingsley, Scheuermann, and Webber, 2009) compared instructional methods CAI, direct teach, and the combination of both instructional methods in an alternating treatment single subject design. Outcomes varied by student and variables such as IQ, age, and attendance seemed to influence mathematical performance improvement. The majority of students benefited most from the combination of CAI and direct teach methods (7 of 10 subjects). However, all students demonstrated some improvement with exposure to all three treatments overtime (Billingsley et al., 2009). The use of technology certainly needs further attention, as results are mixed.

Gaps and Limitations in the Intervention Research-Base

After reviewing these four areas of intervention, it is evident that the research examining mathematics and students with EBD is severely limited (Hodge et al., 2004; Lane, 2004; Reid et al., 2004; Wagner et al., 2006). Published literature reviews have reported similar outcomes. Lane (2004) included only 11 studies relating to EBD and mathematics. Hodge and colleagues (2006) reported 13 studies. The current status of research for intervention and instruction of students with EBD in math is somewhat discouraging. But, this overview does demonstrate that there are promising interventions for student with EBD. The next section will examine gaps in the research given what we currently know about effective practices for EBD and mathematics.

The presented research highlights the dearth of information pertaining to instruction of students with EBD that has been examined. Unfortunately, because the research is limited, the field is not in a position to deem any of the reviewed interventions as having a strong evidence base. The first weakness or gap in the literature is the actual number of intervention studies that have been published. Replication of intervention studies is necessary to better distinguish effective practices from ineffective ones (Pierce et al., 2004). Another limitation is that a majority of the research uses single subject design, making generalizablity across the heterogeneous EBD population difficult (Lane, 2004; Pierce et al., 2004; Templeton et al., 2008). While, it is acknowledged that single-subject design is important to determine interventions that are worthy of larger scale analyses, future research should utilize group design studies when possible. There also exists a lack of consistency in reporting demographic data for participating students (Lane, 2004; Reid et al., 2004). This inconsistent reporting renders it difficult to determine what interventions are the most effective for different types of students.

A major flaw in all of the research on mathematics instruction for students with EBD is the lack of research on higher-level mathematics. The NCTM curriculum guidelines emphasize higher-order thinking such as problem solving and yet only one study was found that addressed problem-solving skills (Scruggs et al., 1986). And despite the study's inclusion of word problems, problem solving was not one of the targeted outcomes; Students were taught test-taking strategies related to the SAT and the instruction included attending to keywords in word problems. NCTM highlights problem solving as a hallmark of mathematical performance yet it is unknown to what degree recommended practices improve the problem solving performance of students with EBD (Hodge et al., 2006). It is imperative that future intervention research evaluates instruction that addresses mathematics skills beyond computation and procedural skills.

Statement of Purpose

Given the poor academic outcomes for students with and at-risk for EBD, it is imperative that the field evaluate current as well as potential practices in order to improve outcomes for these students. The review of literature highlighted practices that are recommended for mathematics instruction for both typically developing students and those with and at-risk for disabilities paying particular attention to middle school students (see Table 2 for an overview of the recommendations). The research addressing teacher practices for students with EBD has mainly focused on secondary and elementary students, leaving a gap in the investigation of middle school age students. Given the emphasis on preparation for algebra, middle school mathematics instruction becomes an essential springboard to preparing students for these higher-level secondary mathematics courses (NMAP, 2008). This study aimed to examine this gap in the research literature.

This research study intended to (a) investigate the qualifications and training of those teaching students with and at-risk for EBD mathematics, (b) examine whether teachers provide access to the recommended curriculum standards and (c) examine the instructional practices being implemented by mathematics teachers in general education and special education settings for students with challenging problem behavior. A survey of Missouri general and special education middle school teachers of mathematics was conducted to examine the aforementioned areas.

Table 2

Recommended Curriculum and Instructional Practices Across Sources

Recommendation/Focus	NCTM	NMAP	IES/WWC	EBD Research and Literature
Number and operations (including fractions)	X	X		
Algebra	X	X		
Geometry	X	X		
Measurement	X	X		
Data analysis and probability	X	X		
Problem-solving	X	X		
Reasoning and proof	X			
Communication	X	X		
Connections	X	X		
Representation (a variety)	X	X	X	

Logical progression of curriculum		X		
Conceptual understanding		X		
Procedural fluency		X	X	
Strategic competence		X		
Adaptive reasoning		X		
Productive disposition		X		
Real world problems		X		
Teacher training		X		
Balanced instructional approach		X		
Use of technology		X		X
Formative assessment		X	X (as part of RtI)	
Increasing/Maintaining Time on Task & Academic Engagement				X
Use of specific praise/reinforcement				X
Opportunities to respond (OTR)				X
Matching instruction & curricula to student ability				X
Explicit/Systematic instruction (teacher demonstration and modeling, guided practice, corrective feedback, & student verbalization		X	X	X (direct instruction in BD literature)
Instruction in word problem structures			X	
Student mediated intervention (self-monitoring)				X
Peer tutoring/cooperative learning				X
Strategy instruction (general)			X	X
Cover, Copy, Compare				X
Mnemonics				X
PBS (token economies, reinforcement)				X

Research Questions

The study was designed to answer the following research questions:

1) Who is teaching mathematics to middle school students with and at-risk for EBD?

 1a) What qualifications do teachers have to teach mathematics?

 1b) What qualifications do teachers have to teach students of special education/EBD?

 1c) Where does instruction occur?

2) Are there mathematics curriculum implementation differences between mathematics and special education teachers?

 2a) Are teachers aware of the NCTM recommendations?

 2b) Are teachers aware of Missouri Grade Level Expectations (GLEs)?

 2c) Do teachers implement NCTM recommended curricula for middle school grades?

 2d) Do teachers implement curriculum recommendations from NMAP & IES practice guides?

 2e) How do teachers rate the impact of curricula on outcomes for students with and at-risk for EBD?

3) Are there instructional differences in mathematics between mathematics and special education teachers?

 3a) Are middle school mathematics and special education teachers using recommended and evidence-based instructional strategies?

 3b) How do teachers rate the impact of instructional practice recommendations on outcomes for students with and at-risk for EBD?

3c) What student and teacher factors do middle school mathematics and special education teachers perceive as negatively impacting outcomes for students with/at-risk for EBD?

3d) Do teachers focus more on behavioral or academic interventions or both?

3e) Do teachers feel that students must have basic skills mastery prior to learning more complex concepts?

Significance of Study

The results of this study have the potential to impact both research and instructional practice in mathematics for students with and at-risk for EBD. Results may help reveal what practices are currently occurring in the mathematics instruction of students with and at-risk for EBD in order to establish a framework for improved instructional practices and future research. The exploratory and descriptive data gathered will establish information about the current state of instruction for students with and at-risk for EBD in Missouri middle schools.

Need for Study

To date, there are no studies focused on instructional practices specifically for middle school students with and at-risk for EBD in mathematics. Given the need for improved practices for academic instruction for this population of students (Bradley et al., 2004; Wiley et al., 2008), the importance of middle school mathematics instruction to prepare students for high school and beyond, and the lack of research specific to the middle school population, the gap in the research literature should to be addressed.

CHAPTER II

METHODOLOGY

Overview

This exploratory survey study investigated instructional practices in mathematics for middle school students with and at-risk for Emotional and Behavioral Disorders (EBD). The research is exploratory in that, to the investigator's knowledge, this is the first study of its kind to focus specifically on the middle school student and teacher population. As addressed in Chapter I, there are three primary research questions with sub-questions for this study:

1) Who is teaching mathematics to middle school students with and at-risk for EBD?

 1a) What qualifications do teachers have to teach mathematics?

 1b) What qualifications do teachers have to teach students of special education/EBD?

 1c) Where does instruction occur?

2) Are there mathematics curriculum implementation differences between mathematics and special education teachers?

 2a) Are teachers aware of the NCTM recommendations?

 2b) Are teachers aware of Missouri Grade Level Expectations (GLEs)?

 2c) Do teachers implement NCTM recommended curricula for middle school grades?

 2d) Do teachers implement curriculum recommendations from NMAP & IES practice guides?

 2e) How do teachers rate the impact of curricula on outcomes for students with and at-risk for EBD?

3) Are there instructional differences in mathematics between mathematics and special education teachers?

3a) Are middle school mathematics and special education teachers using recommended and evidence-based instructional strategies?

3b) How do teachers rate the impact of instructional practice recommendations on outcomes for students with and at-risk for EBD?

3c) What student and teacher factors do middle school mathematics and special education teachers perceive as negatively impacting outcomes for students with/at-risk for EBD?

3d) Do teachers focus more on behavioral or academic interventions or both?

3e) Do teachers feel that students must have basic skills mastery prior to learning more complex concepts?

A survey of Missouri general and special education middle school teachers of mathematics was conducted to answer the three research questions.

Design

A survey design was employed to collect descriptive data to determine the current state of mathematics education for students with and at-risk for EBD in Missouri middle schools. To address the proposed research questions this study was conducted in four phases: (1) survey questionnaire design, (2) pilot testing of survey questionnaire, (3) distribution of questionnaire, and finally (4) analysis of survey responses. Each phase is consistent with typically recommended practices of survey research (Fink, 2009; Gall, Gall, & Borg, 2007; Nardi, 2006; Sue & Ritter, 2007).

Procedures

Phase 1: Survey Questionnaire Design

Selection of topics for investigation. Prior to building the survey instrument, a thorough review of the literature was conducted to determine recommended practices. Recommendations for curriculum emphasis and instructional practices, as summarized in the literature review, were synthesized, compiled and cross-referenced (see Table 2). Sources for curriculum and practice recommendations included publications by the National Council for Teachers of Mathematics (NCTM), the National Mathematics Advisory Panel (NMAP, 2008), the What Works Clearinghouse and the research literature for students with and at-risk for emotional and behavioral disorders.

Developing instrumentation. The development of the online survey instrument involved five-steps: (1) organization of topics, (2) establish survey framework, (3) formatting of draft, (4) expert review of draft, and (5) formatting final online version of survey. In Step 1, recommendations for middle school mathematics curricula and teacher instructional practices were organized. NCTM curriculum focal points (2006) were summarized and the instructional recommendations presented in the literature review were whittled to short concise statements. In Step 2, previous survey research studies, looking at teacher practices were reviewed to help establish a framework for the current investigation (Gagnon & Maccini, 2007; Jackson & Neel, 2006; Maccini & Gagnon, 2002, 2006; van Garderen, 2008). Based on previous studies and the typically recommended practices of survey construction, a likert-scale questionnaire with additional close-ended and rank order questions was determined to be an appropriate method for eliciting responses to the established research questions (Fink, 2008; Sue & Ritter, 2007).

In Step 3, the compiled recommendations were organized into a written draft questionnaire. The design followed guidelines established for survey research from *Doing Survey Research: How to Conduct Surveys: a Step by Step Guide (Fink, 2008), Survey Research Methods: Applied Social Research Methods (Fowler, 2008), Educational Research: An Introduction (Gall, Gall, & Borg, 2007), Doing Survey Research: A Guide to Quantitative Measures (Nardi, 2006) and Conducting Online Surveys (Sue & Ritter, 2007).* The draft survey included both open and closed-ended questions for demographic and qualifying information, Likert Scale questions to allow for scaled responses of attitudes or perceptions in increments, and fixed response multiple choice and rank order questions (Gall, Gall & Borg, 2007; Sue & Ritter, 2007).

Likert Scales are capable of quantitatively measuring perceived knowledge, importance, impact and frequency of use. These are the main areas of focus for this study. Likert Scales also allow for weighted responses to be easily analyzed using quantitative measures (Gall, Gall & Borg, 2007). The initial draft also included a section regarding instructional barriers to elicit teacher feedback on perceived reasons students with and at-risk for EBD experience poor outcomes.

During Step 4, in addition to following the previously stated guidelines, the survey was evaluated by both the dissertation committee and six “experts” in the field to establish content validity (Fink, 2008; Nardi, 2006). The experts included four researchers familiar with mathematics instruction and survey research, one expert in mathematics education, and one expert in survey research of teachers. The draft instrument was sent via email to the field experts. Based on feedback provided, the survey was adjusted and modified. Some of the modifications included adjusting the wording of questions, adding examples of instructional practices, including a few non-research based practice examples, and breaking down the barrier questions to separate student and teacher sections. The consensus of experts regarding the content is what establishes the content validity of the measurement tool.

Step 5 of designing the survey instrument was to format it to a web based Internet survey. Using the online survey host Survey Monkey, the draft survey was formatted to pilot with an email distribution (www.surveymonkey.com). Online surveys have several advantages including they are low in cost, efficient, fast, and they are able to reach a wide population, even from a far geographical distance (Granello & Wheaton, 2004; Sue & Ritter, 2007). Given the large population of middle school mathematics and special education teachers across the wide geographic scope of the state of Missouri, the online format was an appropriate choice of distribution methods.

Using an online format also ensures reliability of the survey instrument in that the invitation, presentation, and completion procedures are standardized across all participants and the explanations and definitions are consistent.

The pilot survey was essentially the same format as the research survey with opportunities throughout for feedback regarding content, language, clarity, or any other area the piloting teachers felt needed improvement or adjustment. These opportunities were presented as open spaces for “comments, issues, feedback” in order to elicit candid and detailed responses for follow-up.

The survey instrument was comprised of six major sections: (1) introduction (qualifying information and curriculum awareness), (2) curriculum (use of and effect), (3) instructional practice (use and impact), (4) student barriers, (5) teacher barriers, and (6) demographic information.

The introduction of the survey included definitions of behavior patterns for teachers to be mindful of as they completed questions. The first question, "do you or have you instructed mathematics for students in grades 6, 7, or 8 in general education or special education?" implemented page logic so that if the response to the question was yes, the respondent would be directed to the beginning of the survey and if the response was no, the respondent would be directed to a final "thank you for your time" page. The beginning of the survey also included questions about area of instruction (mathematics, special education, other) and familiarity with various standards questions. These questions were included to gather information regarding different teachers awareness of NCTM standards and Missouri's state grade level expectations (GLEs) in order to determine which set of standards teachers are likely to use when planning instruction for students with or at-risk for emotional and behavioral disorders.

The next main section of the survey addressed the use and effectiveness of twenty-four recommended mathematics curriculum areas. These recommendations were drawn from the NCTM focal points and NMAP findings. Areas of focus included: algebra, geometry, number and operations, problem solving, reasoning, various representations of mathematical operations, strategy use, application of mathematics in outside contexts, and organizing and making connections between mathematical ideas. These recommendations were presented in a likert-scale table and teachers were asked to rank frequency of emphasis on a scale of 1 (never) to 5 (daily). Other response options included "unfamiliar" and "not applicable to grade/instructional area." The same curriculum recommendations were then presented in a likert-scale table for teachers to rate the level of impact each area has from 1 (no impact) to 4 (strong impact).

Once responses were provided for curriculum use and effect, the next section addressed 39 instructional practices. Thirty-three of these practices, based on the reviewed literature, are considered as recommended. Additionally, 6 non-recommended, but often used, practices were also included to explore differences in use across teachers. The non-recommendations were: Independent practice, use of problems that are relevant to each student, flash cards, general small group (teacher led) instruction, small group work (students working together), and use of published curriculum as it is presented (i.e. no adjustment or adaptation). Using the same scale of 1(never) to 5 (daily), with a "not familiar" response option, teachers were first asked to indicate the extent of their use of the 39 presented instructional practices and then to rate the impact and effectiveness of the same practices on a scale of 1(no impact) to 4 (strong impact).

The fourth and fifth sections asked teachers to rank order impact factors for both students and themselves. First they were asked to select and rank order the top 5 (of 14) student factors that negatively impact outcomes for students. Teachers were then presented with follow-up questions relating to intervention focus, behavior, and skills mastery. They were also asked to rank order the top 5 (of 15) teacher factors that impact outcomes for students and to indicate the overall biggest impact on outcomes for students with behavioral challenges.

Finally, teachers were presented with closed ended questions gathering demographic, experience and training information. Once the survey was formatted online, IRB approval was obtained and the research moved to the second main phase of research, piloting the on-line version.

Phase 2: Pilot of Online Survey Instrument

The pilot phase of research involved gathering feedback from ten middle school mathematics teachers and ten middle school special education teachers. It was decided in the initial proposal of the study that teachers of grades 6, 7, and 8 would be included in research. The pilot phase was conducted in order to gather teacher perceptions of the instrument itself as well as responses to the questionnaire. Piloting was also conducted to confirm that the survey was well assembled and taps constructs that will help answer the research questions. This phase also served to highlight any issues or concerns that teachers may have with the construction of the survey (Nardi, 2006).

The first round of emails sent to potential pilot teachers were sent to schools that the researcher had connections with; two schools in a mid-sized district and one in a larger city, both in Missouri. It was sent to 37 teachers of mathematics and special education. Responses from this emailing resulted in complete feedback from 5 mathematics and 5 special education teachers. To reach the targeted 10 mathematics and 10 special education teacher threshold for the pilot, surveys were then sent to 57 teachers from two districts selected based on location; one where the researcher was located in Florida and the other close to the University in Missouri. This emailing resulted in the 5 mathematics teachers and 5 special educators feedback needed to use as pilot data. It should be noted that there were 7 additional responses that were incomplete. One did not instruct mathematics and six that did not complete the survey for unknown reasons.

Based on the pilot responses and feedback, several changes to the survey were made. Most of the adjustments were made to the language and explanations of the various practices and curriculum areas. A few teachers commented that the survey was too lengthy. Unfortunately, all the content of the survey was necessary to answer the research questions and could not be pared down. The time to complete the survey averaged fifteen minutes. Additionally, several of the piloting teachers used the comments sections to express opinions and experiences related to their own teaching. These responses validated the need for this study by providing preliminary evidence that there are issues from both mathematics and special education teachers relating to knowledge of curriculum, instructional practices, and the instruction of students with and at-risk for emotional and behavioral disorders. Upon completion of the pilot phase, the survey was finalized and preparations for larger scale distribution began. The survey instrument was formatted using the layout of the pilot survey with the removal of feedback questions and making the adjustments described in the previous section.

Phase 3: Distribution of Online Questionnaire

Forming a sample. A list (spreadsheet) of grade 6, 7, and 8 teachers of mathematics and special education was obtained from the University of Missouri Office of Social and Economic Data Analysis (OSEDA). OSEDA collects and analyzes data for the Missouri Department of Education (DESE) including a database of teachers. The list was formed by including teachers of grades 6, 7, and 8 for both mathematics and special education in the search terms of the teacher database that OSEDA manages for DESE.

The list provided the first and last names, subjects taught (math or special education), school, and district for 3392 teachers from the 2010-2011 school year organized in an excel spreadsheet. The list also included the email contact information for 1366 teachers. To fill the gaps in the OSEDA list, a search was conducted to gather as many additional emails via the Internet. Using the districts and schools web pages, an additional 1319 email addresses were obtained. Many of the teachers in this search matched up with names that were in the OSEDA list while others were not in the database but were current teachers for the 2011-2012 school year. The final list entered into Survey Monkey for sending a link to the survey included 2806 teachers.

Distribution of survey via email invitation. The survey was distributed with the hopes that a response rate of 50 percent would be obtained, as this would have been more than acceptable, even ideal (Fowler, 2008; Nardi, 2006). However, response rates are commonly less than 50 percent and Web-based surveys rate of response average less than 30 percent (Gagnon & Maccini, 2007; Nardi; Sue & Ritter, 2007). Knowing that independent samples *t* tests would be used to compare the mathematics and special education teacher responses, a power analysis was conducted where the minimum sample size was computed based on a standard medium effect size of .5, a desired power level ($1-\beta$) of .95, and a significance level (α) of .05 for two tailed *t* tests. It was determined that to conduct desired tests, each group needed a minimum sample size of 105.

The first email invitation was sent to 2806 Missouri mathematics and special education teachers. This invitation email included an introduction and explanation of the survey and a link to the actual survey (Appendix B). This initial contact email along with the first introductory page of the survey served as informed consent for participating teachers. With the hopes of increasing the response rate, respondents who completed the survey were invited to enter their names into a drawing for five $100 dollar gift cards to Amazon.com. Material incentives are shown to increase the response rates for online surveys (Sue & Ritter). The initial mailing yielded 364 responses and 13 opt-outs or bounced addresses. All response information and data were kept confidential. Only the primary investigator had access to the password protected Survey Monkey account and all identifying information was dropped prior to analyses.

A second reminder email (Appendix C) was sent three weeks later to the 2429 teachers who had not yet replied to the survey. This follow-up email gathered an additional 262 responses. Of the 626 responses, 368 were completed in full while, 283 had missing values.

Four weeks later, a third mailing was sent to 2152 teachers who had not responded (Appendix D). An email was also sent to the 283 teachers who had missing information or incomplete survey responses to remind them to come back and finish (Appendix E). This mailing resulted in 772 respondents total.

Due to the timing of the third mailing of the survey link being at the end of the fall semester, teachers were contacted one additional time in the New Year. This final email was sent to 1923 teachers who had been previously contacted (Appendix F) and an additional 80 teachers from a district that changed their domain name from the previous school year when the OSEDA data was compiled (Appendix G).

A follow-up review of the original contact list in Survey Monkey revealed discrepancies in viable email addresses. The final list of emails sent to accurate addresses included 2685 teachers total, 1438 mathematics teachers, 1229 special education teachers, and 18 teachers listed under both categories who did not reply thus remaining dually categorized.

The response count was 843 teachers of both mathematics and special education. An overall response rate of 31.39 percent was reached. The response rate for mathematics teachers was 34.14 percent and the rate for special education teachers was 28.07 percent. While the rate of special education teacher response is slightly lower than the hoped for 30 percent, it is not surprising given that many special education teachers do no teach mathematics. These teachers may have not replied to the survey link as it did not apply to them. Response rate challenges will be addressed later in the discussion.

Of these 843 responses, 492 were complete and appropriate for analysis; 299 mathematics teachers and 193 special education teachers. The final response rates based on analyzed survey responses were 18.34% overall, 20.79 percent for mathematics teachers, and 15.7 percent for special education teachers. Despite being lower than hoped for, these numbers were more than sufficient to conduct expected analyses based on the a priori power analysis.

Phase 4: Data Analysis

The final phase of the study involved the statistical analysis of data collected. Prior to actual analysis, the data were screened to ensure that only the 492 appropriate and complete data were included in the data set. The 358 remaining incomplete and inappropriate (e.g. non-mathematics special education teacher, missing values, etc.) surveys were excluded. Excluded and incomplete surveys will be addressed in the discussion. Because the measurement instrument was an online survey, all the data were direct; thus eliminating any data entry or coding procedures (Granello & Wheaton, 2004;

Sue & Ritter, 2007). This ensures reliability of the respondents' data. Data were directly exported from Survey Monkey into the statistical analysis programs SPSS and SAS for analyses.

Statistical data analysis procedures included descriptive statistics, *t* tests to compare group means and chi-square tests to compare proportions between special education and mathematics teachers. Effect sizes were calculated for all *t* tests using Cohen's d. If the F test for equal variances was less than .05, equal variances were not assumed and the Satterthwaite computation of the standard error of the mean, degrees of freedom and *t* value were used. Effect sizes, coefficient phi, were calculated for all chi-square analyses.

CHAPTER III

RESULTS

Overview

This exploratory survey study was conducted to gather data regarding teachers' perceptions on mathematics instruction for students with and at-risk for emotional and behavioral disorders. This chapter presents the analyses of the survey results comparing general education mathematics teachers and special education teachers. Results are reported in relation to the three main research questions.

As discussed in the previous chapter, an overall response rate of 31.39 percent was reached, with response rates of analyzed surveys for mathematics and special education teachers being 20.79 and 15.7 percent respectively. This is consistent with response rates using online formatting and similar special education research (Sue & Ritter, 2007). The final number of surveys with enough complete information used in the analyses was 492, 299 mathematics teachers and 193 special education teachers. These numbers exceeded the minimum, 105 per group, needed based on the a priori power analysis.

In the rating sections of the survey, teachers were given options of "unfamiliar" and "N/A to grade level or do not instruct in this area." These responses were not included in the statistical analyses. While most of the dropped responses were minimal, there were generally more special educator responses left out for curriculum usage and impact ratings and more mathematics teachers not analyzed for instructional practice usage and ratings. It will be noted where unusually large numbers of teachers reported being unfamiliar or did not use a particular curricular recommendation or instructional practice. (See appendix H for complete tables of dropped responses.)

Research Question 1

1) Who is teaching mathematics to middle school students with and at-risk for EBD?

1a) What qualifications do teachers have to teach mathematics?

1b) What qualifications do teachers have to teach students of special education/EBD?

1c) Where does instruction occur?

Demographic data were gathered on sex, age, highest level of education, years of teaching experience, certifications held, areas of instruction, methods courses and location of instruction (see Table 3). Of the 299 mathematics teacher respondents, 80.6% (*n* = 241) were female and 19.4% (*n* = 58) were male. Those who identified themselves as special education teachers were 88.6% female (*n* = 171) and 11.4% (*n* = 22) male. Chi Square test of independence results indicate there were significant differences between sex and teacher type, X^2 (1, N = 492) = 5.5116, p<. 0189. However, the effect size, phi coefficient was -.1058 indicating the strength of association between variables is low. Effect sizes for Chi Square are interpreted as: 0.0 to 0.1 (little or no association), 0.1 to 0.3 (low association) 0.3 to 0.5 (moderate association), and 0.7 to 1.0 (strong association).

The overall mean age for teachers was 40.96. The special education teachers (M = 43.58, SD = 10.47) on average were older than the mathematics teachers (M = 40.0, SD

= 9.84). Results of an independent samples *t* test indicate this difference was significant (t (467) = -3.69, p<. 001). It should be noted that 12 mathematics and 11 special education teachers declined to answer and were therefore not included in the analysis of this variable.

Table 3

Demographic Information by Teacher Type

	Mathematics (n)	%	Special Education (n)	%	Total (n)	%
Sex						
Male	58	19.40	22	11.40	80	16.26
Female	241	80.60	171	88.60	412	83.74
Age (years)						
20-29	51	16.72	18	9.33	69	14.02
30-39	94	31.44	50	25.91	99	20.12
40-49	87	29.10	52	26.94	139	28.25
50-59	46	15.38	50	25.91	96	19.51
60 +	9	3.01	12	6.22	21	4.27
Declined to answer	12	4.01	11	5.70	23	4.67
Mean Age	40.00		43.58			

Teaching Experience and Qualifications

Analyses indicate that no significant differences existed between mathematics teachers (M = 12.74, SD = 7.49) and special education teachers (M = 13.47, SD = 8.46) with respect to years of teaching experience, *t* (490) = -0.99, p<0.32 within the sample (see Table 4). When teachers were compared based on highest level of education completed there were no significant differences between the groups, X^2(*df*=2, N=491) = 0.7401, *p*<0.69. The majorities of both mathematics and special education teachers held master's degrees. One mathematics teacher held a doctorate degree; this teacher was dropped from the chi squared procedure to keep cell sizes larger than 5.

Table 4

Years of Teaching Experience and Level of Completed Education

Years Teaching	Mathematics	%	Special Education	%	Total	%
0-4	29	9.7	26	13.5	55	11.2
5-9	90	30.1	44	22.8	134	27.2
10-14	74	24.7	44	22.8	118	24.0
15-19	54	18.1	35	18.1	89	18.1
20-24	22	7.36	22	11.4	44	9.0
25-29	21	7.0	10	5.2	31	6.3
30-34	7	2.3	8	4.1	15	3.0
35-39	2	0.7	3	1.6	5	1.0
40+	-	-	1	0.5	1	0.2

Level of Completed Education	Mathematics (n)	%	Special Education (n)	%	Total	%
Bachelor's	84	28.1	61	31.6	145	29.5
Master's	198	66.2	121	62.7	319	64.8
Specialist	16	5.35	11	5.7	27	5.5
Doctorate	1	0.33	-	-	1	0.2

The respondent teachers held a variety of teaching certifications (see Table 5). Mathematics teachers most frequently held elementary, secondary mathematics, and middle school mathematics credentials while special education teachers most frequently held elementary, cross-categorical special education, and mild/moderate special education certifications. A Chi Square test for independence was conducted to examine for differences between mathematics and special education teachers. Not surprising, there were significant differences between the groups, X^2 (df=7, N=492) = 440.48, $p <$

.0001 and the effect size, phi coefficient, was large (0.95). Mathematics teachers were more likely to have general education certifications and special education teachers more likely to hold special education credentials.

Table 5

Certifications Held by Teacher Type

Certification	**Mathematics**	**Special Education**
	n (%)	n (%)
Elementary	123 (41.4)	93 (48.2)
Middle School	17 (5.7)	-
Middle School Math	39 (13.0)	7 (3.6)
Secondary Mathematics	169 (56.5)	10 (5.2)
Cross Categorical Special Ed	6 (2.0)	109 (56.5)
Behavior Disorders/ED	2 (0.7)	31 (16.1)
Learning Disabilities	5 (1.7)	59 (30.6)
Mild/Moderate Special Education	2 (0.7)	83 (43.0)
Moderate/Severe Special Education	1 (0.3)	22 (11.4)
Temporary or Emergency Credential	1 (0.3)	3 (1.6)
Administrative Credential	5 (1.7)	3 (1.6)
Other General Education	4 (1.3)	-
Other Special Education	2 (0.7)	6 (3.1)

A *t* test was conducted to determine if the number of certifications differed between mathematics and special education teachers. Results indicate significance between mathematics (M = 2.2575, SD = 0.50) and special education teachers (M = 3.32, SD = 1.19), t (235) = 11.68, $p<0.0001$. The effect size was large, d = 1.16, with special educators holding statistically more certifications than mathematics teachers. Effect sizes for *t* tests calculated using Cohen's d are interpreted as: 0.2 (small), 0.5 (medium), and 0.8 or above (large).

The majority of teachers, 88.6% of mathematics teachers and 72% of special education teachers, have taken mathematics instructional methods courses (Table 6). Just over half, 51.5%, of mathematics teachers have completed special education instructional methods coursework compared to 92.75% of special education teachers. As for instructional methods courses specific to teaching mathematics for special education students, 71% of special education teachers have completed coursework in this area compared with 24.7% of mathematics teachers.

Table 6

Instructional Methods Courses by Teacher Type

Methods Course	Teacher Type	
	Mathematics n (%)	Special Educ. n (%)
Mathematics		
Yes	265 (88.6)	139 (72.0)
No	34 (11.4)	54 (28.0)
Special Education		
Yes	154 (51.5)	179 (92.75)
No	145 (48.5)	14 (7.25)
Special Education Mathematics		
Yes	38 (24.7)	127 (71.0)
No	116 (75.3)	52 (29.0)

Location of Instruction

Instructional locations differed for the groups. The greatest number of mathematics teachers (n = 216) reported teaching in a general education setting while the greatest number of special education teachers reported teaching in a self-contained or pull out resource room setting (n = 154). Reported settings of mathematics instruction are presented in Table 7. A Chi-Square test of independence was conducted to determine if differences in instructional setting between the groups existed, $X^2(5, N = 492) = 352.08$,

$p<0.0001$. Significant differences existed between groups with a large effect size (phi = 0.85).

Table 7

Reported Location of Instruction by Teacher Type

Location	Mathematics Teachers (N)	%	Special Education Teachers (N)	%
General Education	216	72	4	2.1
Collaborative Setting	72	24.1	65	33.7
Inclusion (non-collaborative)	30	10.0	10	5.2
Resource	5	1.7	88	45.6
Self-Contained	1	0.3	65	33.7
Other	12	4.0	11	5.7

Research Question 2

2) Are there mathematics curriculum implementation differences between mathematics and special education teachers?

2a) Are teachers aware of the NCTM recommendations?

2b) Are teachers aware of Missouri Grade Level Expectations (GLEs)?

2c) Do teachers implement NCTM recommended curricula for middle school grades?

2d) Do teachers implement curriculum recommendations from NMAP & IES practice guides?

2e) How do teachers rate the impact of curricula on outcomes for students with and at-risk for EBD?

Teacher Awareness

Prior to assessing the use and impact of NCTM, IES and NMAP curriculum recommendations, teachers were asked questions regarding familiarity and usage of curriculum principles and guidelines. Teachers were asked yes/no "are you familiar with" questions regarding the NCTM Principles and Standards, NCTM Curriculum Focal Points and the Missouri Grade Level Expectations (GLEs). Response totals and chi-squared analyses can be found in Table 8.

Table 8

Familiarity with NCTM Principles and Standards, Curriculum Focal Points, and Missouri GLEs Compared by Teacher Type

		Mathematics		Special Education		Analyses			
		n	%	n	%	df	Chi-Square	p	Effect Size
Familiarity with NCTM Principles and Standards	Y	280	93.65	118	61.14	1	80.1860	<0.0001*	0.40
	N	19	6.35	75	38.86				
Familiarity with NCTM Curriculum Focal Points	Y	186	62.21	62	32.12	1	42.4614	<0.0001*	0.29
	N	113	37.79	131	67.88				
Familiarity with Missouri GLEs	Y	296	99.0	193	100	1	1.9483	0.1628	-0.063
	N	3	1.0	0	0				

*Denotes significance

Mathematics and special education teachers differed significantly in their awareness of the NCTM Principles and Standards and Focal Points with mathematics teachers reporting a significantly greater level of awareness. There were no significant differences in the familiarity with the Missouri GLEs across the two teacher groups.

Teachers were also asked what guidelines they rely on most when planning instruction for students with and at-risk for behavioral challenges (see Table 9). The majority of both groups rely on the Missouri GLEs (63.21% of mathematics teachers and 45.08% of special education teachers). Chi-squared analysis indicates differences between groups, $X^2(4) = 33.5263$, $p<0.0001$ indicating mathematics teachers are more likely to rely on the GLEs compared with their special education counterparts. Mathematics teachers who selected "other" reported using school and building guidelines, IEP goals, and the recommendations of special education co-workers when planning instruction for students with behavioral challenges. The most common "other" for special education teachers were use of IEP goals (n = 24) to guide instruction. Only three teachers, all mathematics, report relying on the NCTM focal points.

Table 9

Guidelines Most Used by Teacher Type

Guidelines	Mathematics		Special Education	
	N	%	N	%
NCTM Focal Points	3	1.0		0
Missouri GLEs	189	63.21	87	45.08
Textbook Guidelines	10	3.34	9	4.66
Local Curriculum Guidelines	66	22.07	40	20.73
Other	31	10.37	57	29.53

Implementation of Recommended Curricula

The overall purpose of research question 2 was to examine if teachers of mathematics and special education implement curricula based on NCTM, IES, NMAP, and/or more general recommendations from special education literature relative to teaching students with and at-risk for EBD. There were twenty-four areas of curriculum recommended for students in middle grades 6-8. Teachers were asked to rate their usage on a scale of 1 (never) to 5 (daily) with options for "unfamiliar" and "not applicable to grade/do not instruct in this area." Only teachers who indicated a rating on the 1 to 5 scale were included in the statistical analyses. Those who indicated unfamiliarity with or non-use of a particular curriculum area were not evaluated (see Appendix H). Independent samples *t* tests were conducted for all included ratings. Effects sizes were calculated using Cohen's d.

To first get a sense of the overall frequency of reported use for both groups, the data were aggregated and compared. Outcomes of these analyses indicate that aggregate mean rating for mathematics teachers were higher overall ($M = 3.51$, $SD = 0.50$) compared to special education teachers ($M = 3.26$, $SD = 0.60$). This difference was statistically significant, $t(219) = 3.74$, $p<.0002$ with an effect size of $d = .45$ approaching moderately strong. The difference in mean scores was small despite the statistical significance.

Of the twenty-four curriculum areas used in instruction, there were statistically significant differences in the frequency of use ratings between mathematics and special educators in twelve (see Table 10). In all twelve areas with significant differences the mathematics teachers' reported usage ratings were higher than the special education teachers. In fact, mathematics teacher ratings were higher than special educators in all but two curriculum areas. Special education teachers rated their use of "theoretical probability/proportion" and the "development and evaluation of mathematical proof" higher than mathematics teachers. Possible reasons for this will be discussed in the next chapter.

While there are expected differences between teacher types, both groups reported overall high levels of curriculum usage with three exceptions: "analysis of two and three-dimensional figures," "development of mathematical proof," and "use of various methods of mathematical proof." These three areas aside, special education teachers' ratings were 2.69 and higher and mathematics teachers' ratings were 2.94 and higher. The three noted exceptions had the lowest ratings by both groups of teachers.

Table 10

Independent Samples t test Statistics for Implementation of Curriculum Recommendations Comparing Mean Usage Ratings of Mathematics and Special Education Teachers

Curriculum Recommendation	*Teacher Type*						
	Mathematics		*Special Education*				
	n	M (SD)	*n*	M (SD)	*t*	*p*	Effect Size (d)
Fluency with and understanding of multiplication and division	286	4.05 (0.89)	181	4.09 (0.90)	-0.51	0.61	0.05
Connection of ration/rate with multiplication and division	293	3.27 (0.77)	171	2.97 (0.95)	3.53	$\leq$0.001*	0.35
Application and understanding of proportionality	292	3.13 (0.75)	174	2.84 (0.88)	3.59	$\leq$0.001*	0.35
Make estimates relating to proportions	288	2.96 (0.85)	179	2.85 (0.84)	1.40	0.13	0.13
Use theoretical probability and proportion to make predictions	295	2.64 (0.79)	174	2.70 (0.91)	-0.73	0.47	0.07
Understanding of mathematical operations on rational numbers	295	4.37 (0.77)	180	3.88 (1.04)	5.78	$\leq$0.001*	0.53
Use of mathematical expressions and equations	295	3.97 (0.83)	178	3.84 (0.96)	1.48	0.14	0.14
Solving linear equations and systems of linear equations	280	3.10 (1.05)	166	2.93 (1.08)	1.66	0.10	0.16
Analyzing and representing linear functions	274	2.94 (0.95)	163	2.69 (1.04)	2.52	0.01*	0.25

Analysis and summarization of data sets	286	2.99 (0.85)	180	2.92 (0.91)	0.78	0.43	0.07
Using formulas to determine area and volume	294	3.02 (0.78)	174	2.93 (0.89)	1.21	0.23	0.12
Analysis of two and three-dimensional figures using distance and angles	279	2.73 (0.74)	172	2.62 (0.85)	1.44	0.15	0.14
Problem-solving	295	4.21 (0.77)	183	3.95 (0.89)	3.23	≤0.001*	0.31
Building new mathematical knowledge through problem-solving	294	4.09 (0.84)	184	3.72 (0.99)	4.26	≤.0001*	0.41
Strategy use for problem-solving	296	4.20 (0.80)	183	4.06 (0.89)	1.72	0.09	0.16
Reflection on the problem-solving process	292	4.06 (0.93)	181	3.83 (1.02)	2.52	0.01*	0.24
Development and evaluation of mathematical proof	213	2.42 (1.02)	149	2.49 (1.20)	-0.56	0.57	0.06
Using various methods of mathematical proof	209	2.22 (1.03)	143	2.06 (1.05)	1.35	0.18	0.15
Communication of mathematical thinking to others	293	3.92 (0.98)	177	3.29 (1.18)	5.93	≤0.001*	0.58
Analyze the mathematical thinking of others	295	3.55 (1.07)	177	3.02 (1.16)	5.01	≤0.001*	0.47
Organization and use of mathematical thinking	294	3.90 (0.96)	180	3.41 (1.12)	4.98	≤0.001*	0.48
Recognition and use of connections between mathematical ideas	291	4.01 (0.91)	177	3.47 (1.07)	5.58	≤0.001*	0.54
Applying mathematics in outside contexts	292	4.13 (0.82)	183	3.98 (0.82)	2.02	0.04*	0.19
Creating representation to organize, record, and communicated mathematics	289	3.83 (0.87)	183	3.81 (0.91)	0.24	0.81	0.02

* Denotes significance

The effect sizes for significant differences were small to medium, indicating that the differences are a result of differences in the two teacher groups. The "communication of mathematical thinking to others," "analyzing mathematical thinking of others," and "organization and use of mathematical thinking" were all statistically higher for mathematics teachers compared to special education teachers and these effect sizes were medium and approaching medium, d = 0.58, 0.47, and 0.48 respectively. According to mathematics teachers' reported frequency of use, two of the four areas of curriculum emphasis that focused on problem-solving were statistically significant over special education teachers reported ratings; however, the effect sizes were both small.

Perceived Impact of Recommended Curricula

Teachers also reported their perceptions of potential impact that each of the twenty-four areas of curriculum may have on the mathematics achievement of students with behavioral challenges. Teachers were asked to indicate the level of potential impact on a scale of 1 (no impact) to 4 (strong impact). They were presented with options for "unfamiliar" and "not applicable to grade level/do not instruct." Teachers that indicated either of these options were not included in the analysis. Data were aggregated to gather overall means for this set of questions as well. Mathematics teachers (M = 3.12, SD = 0.51) and special education teachers (M = 2.92, SD = 0.62) had significant differences, *t* (206) = 2.88, $p<0.0044$, d = 0.35 in their overall aggregated scores. Simply put, mathematics teachers rated potential impact of the listed curricula generally higher than special educators.

Thirteen areas differed statistically between groups in impact ratings. Twelve of the thirteen areas of statistical difference are the same areas that teachers' reported differences in usage. Table 11 displays curriculum impact ratings for mathematics and special education teachers. The one area that was significantly different for impact but was not significantly different in usage was "strategy use for problem solving," most likely because of the closeness in mean scores.   Interestingly, both groups of teacher gave this item the highest potential impact score (mathematics 3.60 and special education 3.39).

Other top areas that mathematics teachers rated as having a potentially high impact were "fluency with and understanding of multiplication and division," "understanding of mathematical operations on rational numbers," "problem-solving," and "building new knowledge through problem-solving." All mean ratings were about 3.5, between moderate and strong impact. Special education teachers' additional items with high ratings were in three of four of the same areas, "fluency with and understanding of multiplication and division," "understanding of mathematical operations and problem solving." These means were all above 3.28, above moderate.

Table 11

Independent Sample t Test Statistics for Perceived Impact of Curriculum Recommendations

Curriculum Recommendation	*Mathematics*		*Special Education*				
	n	M (SD)	*n*	M (SD)	*t*	*p*	Effect Size
Fluency with and understanding of multiplication and division	292	3.59 (0.67)	181	3.50 (0.72)	1.46	0.15	0.14
Connection of ration/rate with multiplication and division	290	3.05 (0.76)	171	2.85 (0.90)	2.48	0.01*	0.24*
Application and understanding of proportionality	290	2.98 (0.77)	171	2.76 (0.92)	2.73	0.007*	0.26*
Make estimates relating to proportions	287	2.86 (0.81)	171	2.67 (0.85)	2.39	0.017*	0.26*
Use theoretical probability and proportion to make predictions	292	2.59 (0.77)	163	2.62 (0.85)	-0.39	0.696	0.04
Understanding of mathematical operations on rational numbers	292	3.57 (0.70)	176	3.28 (0.80)	4.01	≤0.001*	0.39*
Use of mathematical expressions and equations	294	3.28 (0.76)	176	3.15 (0.84)	1.66	0.097	0.16
Solving linear equations and systems of linear equations	272	2.78 (0.94)	161	2.58 (0.88)	2.21	0.028*	0.22*
Analyzing and representing linear functions	272	2.66 (0.88)	160	2.45 (0.90)	2.40	0.017*	0.24*
Analysis and summarization of data sets	290	2.86 (0.82)	171	2.75 (0.89)	1.35	0.18	0.13

Using formulas to determine area and volume	296	2.96 (0.78)	171	2.89 (0.89)	0.97	0.33	0.09
Analysis of two and three-dimensional figures using distance and angles	281	2.71 (0.78)	170	2.61 (0.90)	1.27	0.20	0.13
Problem-solving	291	3.53 (0.73)	180	3.42 (0.75)	1.66	0.10	0.16
Building new mathematical knowledge through problem-solving	291	3.51 (0.74)	178	3.18 (0.86)	4.23	≤0.001*	0.41*
Strategy use for problem-solving	291	3.60 (0.69)	179	3.39 (0.78)	3.13	0.002*	0.29*
Reflection on the problem-solving process	290	3.38 (0.82)	178	3.20 (0.86)	2.26	0.02*	0.21*
Development and evaluation of mathematical proof	212	2.28 (0.98)	148	2.31 (0.99)	-0.28	0.79	0.01
Using various methods of mathematical proof	211	2.25 (0.98)	140	2.18 (0.95)	0.64	0.52	0.07
Communication of mathematical thinking to others	293	3.30 (0.82)	175	2.89 (0.95)	4.82	≤0.001*	0.47*
Analyze the mathematical thinking of others	290	3.15 (0.84)	174	2.69 (0.94)	5.48	≤0.001*	0.52*
Organization and use of mathematical thinking	290	3.36 (0.81)	178	2.97 (0.91)	4.79	≤0.001*	0.48*
Recognition and use of connections between mathematical ideas	290	3.36 (0.76)	179	3.06 (0.85)	3.88	≤0.001*	0.36*
Applying mathematics in outside contexts	289	3.49 (0.76)	178	3.35 (0.78)	1.84	0.07	0.17
Creating representation to organize, record, and communicated mathematics	286	3.35 (0.76)	177	3.22 (0.83)	1.68	0.09	0.16

*Denotes significance

Research Question 3

3) Are there instructional differences in mathematics between mathematics and special education teachers?

3a) Are middle school mathematics and special education teachers using recommended and evidence-based instructional strategies?

3b) How do teachers rate the impact of instructional practice recommendations on outcomes for students with and at-risk for EBD?

3c) What student and teacher factors do middle school mathematics and special education teachers perceive as negatively impacting outcomes for students with/at-risk for EBD?

3d) Do teachers focus more on behavioral or academic interventions or both?

3e) Do teachers feel that students must have basic skills mastery prior to learning more complex concepts?

Use of Recommended and Evidence-Based Instructional Practices

Teachers were presented with thirty-nine instructional practice recommendations and asked to rate their usage on a scale of 1 (never) to 5 (daily). Thirty-three of the instructional strategies were based on recommendations found in the EBD and special education literature and the IES, NMAP, and NCTM guidelines. Six additional strategies were included that at present have limited to no research-base but are often found within classrooms.

Aggregate means were calculated for all ratings of implementation frequency. The total mean ratings indicate significant differences between teacher groups. Mathematics teachers ($M = 3.75$, $SD = 0.43$) usage ratings were less than special education teacher ratings (M = 3.95, SD = 0.48), $t(324) = -3.98$, $p<0.0001$, with a medium effect size, d = .45.

Statistically significant differences between groups were present for twenty-two of the recommended practices and for three of the non evidence-based practices (see Table 12). Of the twenty-two practices that differed, special education teachers' usage ratings were higher than mathematics teachers in eighteen. Special education teachers' usage ratings were higher for practices relating to "individualization of instruction," "practicing facts and foundational skills," "organization and strategy instruction," and "behavior and classroom management." The four instructional strategies that mathematics teachers reported using more frequently were "use of formative assessment," "directing students to use visual representations," "peer tutoring," and "cross-age tutoring." These results are interesting given the emphasis of on-going assessment within the field of special education and the research on peer tutoring for students with disabilities.

As would be expected given the focus of special education, the five instructional practices that involve individualization all yielded statistically significant differences where the special education teachers indicated more frequent usage compared to mathematics teachers. For "individualization of materials" special education (M = 4.36) and mathematics (M = 3.34) teachers had significant differences, $p<0.0001$ with a large effect size, d = 0.98. With the "adjustment of task difficulty," special education teachers reported more frequent usage compared to mathematics teachers with another large effect size, d = 0.81. Special education teachers reported selecting "ability appropriate lessons" and "providing additional time and practice opportunities" more frequently than mathematics teachers. Finally, “individualizing by reducing workload” usage was reported far more frequently for special educators (M = 4.30) compared with mathematics educators (M = 3.75).

The lowest overall usage ratings were for “cross-age tutoring,” which was statistically different for the teacher groups, but ratings were very low for both teacher groups with mathematics teachers’ mean reported usage slightly higher. The use of “flashcards” and “cover copy compare” were also low for both teacher groups but special education teachers’ usage was slightly higher than mathematics teachers; these ratings were all below 2.89 or less indicating usage was “sometimes/monthly.”

The overall highest reported usage rates for both groups were for instructional practices relating to explicit instruction (i.e., “teacher demonstration,” “guided practice,” “corrective feedback”) and “behavior or classroom management.” Teachers reported using explicit instructional strategies above 4.71 (approaching daily use) and the teacher groups only differed on average by a maximum of 0.05 with special education reported usage slightly higher. Behavior and classroom management ratings were 4.35 or above for mathematics teachers and 4.58 or above for special education teachers.

Three of the six instructional practices that are commonly used in classrooms, but are not recommended by the NCTM, NMAP, IES or supported by research in the field of behavioral disorders, resulted in statistically significant differences between groups of teachers. The first was the use of “problems that are relevant to each student.” Mathematics teachers’ usage ratings were less than special education teachers; this difference was significant with a small effect size. Special education teachers also reported using “flashcards” more frequently than mathematics teachers but both ratings were lower than 2.89, indicating sometimes/monthly usage. The final difference was on the use of "small group teacher lead instruction." Special educators reported using this strategy significantly more often ($M = 4.39$; $p<0.000$; $d = 1.06$) than their mathematics colleagues ($M = 3.37$). This result is not surprising given the earlier finding indicating most special educators delivered math instruction in self-contained or pull-out resource rooms.

Table 12

Independent Samples t test Statistics for Instructional Practice Usage Comparing Mean Frequency Ratings of Mathematics and Special Education Teachers

Instructional Practice	*Teacher Type*						
	Mathematics		*Special Education*				
	n	M (SD)	*n*	M SD	*t*	*p*	Effect Size (d)
Teacher demonstration and modeling	294	4.82 (0.43)	191	4.87 (0.43)	-1.35	0.179	0.13
Guided practice	295	4.81 (0.45)	192	4.84 (0.40)	-0.80	0.427	0.08
Corrective feedback	295	4.71 (0.49)	192	4.73 (0.48)	-0.65	0.52	0.06
Providing time for student verbalization	295	4.44 (0.66)	192	4.54 (0.65)	-1.67	0.096	0.16
Independent practice **	295	4.80 (0.45)	191	4.74 (0.49)	1.35	0.177	0.12
Providing multiple OTRs	276	4.52 (0.67)	188	4.62 (0.67)	-1.56	0.12	0.15
Use of ongoing formative assessment to guide instruction	295	4.21 (0.70)	190	3.95 (0.77)	3.32	0.0010*	0.35
Use of problems with scenarios that may occur in "real world" situations	294	4.31 (0.63)	191	4.21 (0.68)	1.57	0.118	0.14
Use of problems that are relevant to each student **	296	3.95 (0.75)	188	4.12 (0.83)	-2.37	0.018*	0.22
Instruction in word problem structure	295	3.92 (0.73)	190	3.86 (0.84)	0.74	0.458	0.07

Use of visual representations for modeling	295	4.15 (0.73)	192	4.27 (0.71)	-2.12	0.035*	0.17
Directing student to use visual representations	295	4.12 (0.75)	191	3.95 (0.93)	2.11	0.035*	0.20
Use of manipulatives	294	3.39 (0.82)	189	4.01 (0.88)	-7.81	<0.0001*	0.72
Use of graduated instruction or C-S-A	255	3.16 (1.07)	176	3.38 (1.11)	-2.10	0.036*	0.21
Technology for instruction	294	3.59 (1.20)	190	3.49 (1.20)	0.92	0.36	0.09
Technology for practice or review	293	3.13 (1.21)	189	3.40 (1.16)	0.49	0.01*	0.23
Fast fact practice	294	2.95 (1.28)	189	3.21 (1.24)	-2.15	0.032*	0.23
Flash cards **	294	2.11 (0.97)	187	2.89 (1.18)	-7.93	<0.0001*	0.20
Foundational skills practice and review	292	3.49 (1.00)	188	3.77 (1.04)	-2.97	0.003*	0.28
Peer tutoring	295	3.65 (0.91)	188	3.39 (1.07)	2.77	0.006*	0.26
Cross-age tutoring	288	1.78 (1.04)	182	2.21 (1.27)	-3.81	0.0002*	0.37
Small group instruction **	294	3.37 (1.06)	192	4.39 (0.85)	-11.68	<0.0001*	1.06
Small group work **	291	3.97 (0.82)	187	3.95 (1.03)	0.23	0.82	0.02
Use of published curriculum or district adopted curriculum as it is presented	291	3.95 (1.20)	188	3.90 (1.20)	0.47	0.638	0.04
Individualization of materials	295	3.34 (1.14)	191	4.36 (0.93)	-10.73	<0.0001*	0.98

Adjusting task difficulty	296	3.60 (1.10)	191	4.40 (0.85)	-8.97	<0.0001*	0.81
Selection of ability appropriate lessons and/or curricula	294	3.77 (1.12)	191	4.45 (0.78)	-7.83	<0.0001*	0.70
Providing additional time and opportunities for practice	295	4.29 (0.72)	191	4.60 (0.59)	-5.24	<0.0001*	0.48
Reduction of workload	294	3.75 (1.07)	192	4.30 (0.91)	-6.08	<0.0001*	0.56
Graphic organizers	294	3.35 (1.00)	192	3.77 (1.02)	-4.42	<0.0001*	0.41
Strategy training	289	2.90 (1.15)	186	3.44 (1.17)	-4.96	<0.0001*	0.47
Setting up self-management or self-monitoring programs	291	2.72 (1.34)	189	3.32 (1.26)	-4.91	<0.0001*	0.46
Instruction in self-talk	288	2.75 (1.26)	188	3.15 (1.18)	-3.47	0.0006*	0.33
Cover copy compare	277	2.25 (1.22)	173	2.43 (1.23)	-1.59	0.113	0.15
Mnemonic devices	292	3.18 (0.97)	189	3.29 (1.04)	-1.08	0.28	0.10
Use of reinforcement for appropriate behavior	294	4.35 (0.82)	192	4.58 (0.67)	-3.31	0.001*	0.30
Correction of undesirable behavior	293	4.55 (0.72)	189	4.61 (0.71)	-1.01	0.311	0.09
Maintaining or adjusting classroom management to better suit particular students	295	4.45 (0.76)	191	4.62 (0.61)	-2.50	0.013*	0.24
Adjusting classroom routines to encourage and promote appropriate behavior	294	4.38 (0.80)	189	4.60 (0.68)	-3.23	0.0013*	0.27

*Denotes significance **denotes commonly used practice

Perceived Impact of Recommended and Evidence-based Instructional Practices

Similar to the previous set of curriculum survey items, teachers were asked to rate the potential impact and effectiveness of the listed instructional practices with respect to students at-risk or those with EBD. The differences between the groups for perceived impact ratings were not as large as reported usage of the practices. Aggregated totals for both groups indicated that mathematics teachers' perceived potential impact (M = 3.44, SD = 0.49) slightly less than special education teachers (M = 3.52, SD = 0.40), however differences for these means were not significant and both groups were generally positive.

With the exceptions of "cross-age tutoring" and "cover copy compare," overall mean ratings for impact of recommended instructional practices were high for both groups of teachers (see Table 13). Mathematics teachers' ratings were 3.04 or higher and special education teachers' ratings were 3.03 or higher. The low ratings for "cross-age tutoring" and "cover copy compare" are consistent with the low frequency of usage ratings reported in the previous section.

Statistically significant differences were found between teacher groups for the explicit instruction practices of "teacher demonstration and modeling" and "guided practice." Despite the statistical difference, the mean impact ratings for both teacher types were 3.68 or higher indicating that both mathematics and special education teachers perceived these practices as having a potential strong and positive impact on student outcomes.

Similar to the ratings for instructional practice use, the five practices related to individualization of instruction had significant differences in impact ratings where, again, special education teachers' ratings were higher than mathematics teachers. As for behavior and classroom management areas, there were no differences and overall the impact ratings were high for both teacher groups, 3.47 and higher.

With respect to the items of "ongoing formative assessment" and "peer tutoring," mathematics teachers rated both statistically higher than special education teachers. As for use of ongoing formative assessment to guide instruction, mathematics teachers' impact ratings, much like their usage ratings, were higher (M = 3.58) than special education teachers' (M = 3.43) with a small effect size. The other difference of interest was "peer tutoring" where ratings from mathematics teachers (M = 3.26) were higher than special education teachers (M = 3.03) given peer tutoring is considered an evidence-based practice and routinely recommended in the field of special education.

Two areas that were not different in usage ratings had significant differences with regard to impact on outcomes ratings: "Use of problems relevant to each student" and "small group work." Both were rated as having a slightly, but significantly, greater impact by special education teachers compared to mathematics teachers.

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Table 13

Independent Samples t test Statistics for Impact Ratings of Instructional Practices Comparing Mathematics and Special Education

Instructional Practice	*Teacher Type*						
	Mathematics		*Special Education*				
	n	*M (SD)*	*n*	*M (SD)*	*t*	*p*	*Effect Size (d)*
Teacher demonstration and modeling	295	3.68 (0.59)	192	3.78 (0.48)	-2.02	0.0442*	0.18
Guided practice	294	3.72 (0.54)	192	3.83 (0.42)	-2.38	0.0176*	0.22
Corrective feedback	295	3.74 (0.53)	190	3.73 (0.52)	0.19	0.85	0.02
Providing time for student verbalization	290	3.61 (0.65)	190	3.58 (0.66)	0.46	0.648	0.04
Independent practice **	295	3.58 (0.68)	191	3.62 (0.63)	-0.65	0.514	0.06
Providing multiple OTRs	266	3.56 (0.67)	184	3.59 (0.68)	-0.56	0.576	0.05
Use of ongoing formative assessment to guide instruction	292	3.58 (0.68)	189	3.42 (0.71)	2.46	0.014*	0.23
Use of problems with scenarios that may occur in "real world" situations	294	3.54 (0.69)	189	3.60 (0.62)	-0.97	0.332	0.09
Use of problems that are relevant to each student **	293	3.52 (0.69)	184	3.67 (0.57)	-2.59	0.010*	0.24
Instruction in word problem structure	293	3.45 (0.75)	187	3.37 (0.70)	1.14	0.255	0.11
Use of visual representations for modeling	293	3.59 (0.65)	186	3.70 (0.55)	-1.96	0.051	0.18

Directing student to use visual representations	293	3.48 (0.72)	183	3.57 (0.64)	-1.38	0.167	0.13
Use of manipulatives	286	3.31 (0.78)	180	3.57 (0.68)	-3.86	<0.0001*	0.36
Use of graduated instruction or C-S-A	210	3.13 (0.85)	150	3.07 (0.88)	0.65	0.517	0.07
Technology for instruction	280	3.32 (0.79)	180	3.39 (0.74)	-0.96	0.337	0.09
Technology for practice or review*	274	3.21 (0.85)	181	3.43 (0.72)	-2.93	0.0036*	0.28
Fast fact practice	279	3.04 (0.92)	177	3.09 (0.88)	-0.55	0.585	0.05
Foundational skills practice and review	289	3.37 (0.78)	182	3.44 (0.68)	-1.03	0.302	0.10
Peer tutoring	289	3.26 (0.76)	174	3.03 (0.83)	3.02	0.003*	0.28
Cross-age tutoring	194	2.72 (0.95)	152	2.70 (1.03)	0.12	0.907	0.01
Small group instruction **	282	3.48 (0.70)	183	3.74 (0.49)	-4.86	<0.0001*	0.44
Small group work **	291	3.37 (0.73)	178	3.57 (0.63)	-3.03	0.0026*	0.28
Use of published curriculum or district adopted curriculum as it is presented **	277	3.06 (0.87)	179	2.99 (0.87)	0.87	0.385	0.08
Individualization of materials	279	3.43 (0.75)	186	3.77 (0.51)	-5.92	<0.0001*	0.54
Adjusting task difficulty	286	3.40 (0.75)	186	3.77 (0.48)	-6.52	<0.0001*	0.59
Selection of ability appropriate lessons and/or curricula	288	3.52 (0.68)	184	3.76 (0.51)	-4.38	<0.0001*	0.40
Providing additional time and opportunities for practice	295	3.61 (0.64)	186	3.79 (0.47)	-3.47	0.0006*	0.31

Reduction of workload	291	3.25 (0.80)	188	3.52 (0.67)	-3.92	<0.0001*	0.36
Graphic organizers	280	3.21 (0.81)	182	3.36 (0.75)	-1.72	0.087	0.16
Strategy training	271	3.24 (0.82)	171	3.33 (0.77)	-1.12	0.262	0.11
Setting up self-management or self-monitoring programs	253	3.09 (0.85)	177	3.11 (0.88)	-0.31	0.758	0.03
Instruction in self-talk	235	3.11 (0.85)	174	3.01 (0.81)	1.14	0.257	0.11
Cover copy compare	196	2.86 (0.92)	140	2.69 (0.93)	1.68	0.094	0.19
Mnemonic devices	273	3.31 (0.79)	181	3.14 (0.85)	2.21	0.028*	0.21
Use of reinforcement for appropriate behavior	286	3.71 (0.53)	185	3.69 (0.56)	0.45	0.6499	0.04
Correction of undesirable behavior	289	3.51 (0.66)	186	3.47 (0.66)	0.27	0.786	0.05
Maintaining or adjusting classroom management to better suit particular students	287	3.72 (0.56)	186	3.74 (0.52)	-0.47	0.635	0.04
Adjusting classroom routines to encourage and promote appropriate behavior	285	3.71 (0.57)	186	3.76 (0.48)	-1.01	0.315	0.09

*Denotes significance **denotes commonly used practice

Factors that Impact Instruction and Student Outcomes

Teachers were also asked several questions to form a clearer picture of who is teaching students with and at-risk for EBD and what these teachers report are the challenges and barriers associated with implementing recommended curricula and instructional strategies when teaching these students. Teachers were first asked to rank the top factors that have the greatest negative impact on outcomes for students with behavioral challenges. The most commonly identified barrier across both teacher groups was the "lack of student prerequisite skills and knowledge" (see Table 14). The second most common barrier noted by both teacher groups was "lack of effort" on the student's part. Mathematics teachers ranked "lack of study skills and work habits" as the third barrier to success while special education teachers noted "the inability to process content" and "externalizing behavior patterns" as the third ranked barrier.

Table 14

Response counts for Greatest Negative Impact Factor by Teacher Type

Impact Factors	Special Education	Mathematics
	% (Rank)	% (Rank)
Lack of student prerequisite skills	35.23% (1)	38.8 (1)
Lack of Effort	11.40 (2)	21.07 (2)
Externalizing behavior patterns	9.33 (4)	5.67 (5)
Inability to process content	9.33 (4)	5.02 (6)
Lack of study skills and work habits	6.74 (6)	8.03 (3)
Lack of relationship with adults/teachers	6.74 (6)	4.35 (7)
Absenteeism	5.18 (7)	6.69 (4)

Disinterest in subject matter	4.66 (8)	2.34 (8)
Lack of participation	3.63 (9)	1.34 (12)
Inability to work independently	3.11 (10)	1.67 (10)
Students enrolled in inappropriate level of course	1.55 (11)	1.34 (12)
Unprepared	1.04 (14)	1.00 (13)
Lack of relationship with peers	1.04 (14)	0.33 (15)
Internalizing behavior patterns	1.04 (14)	0.33 (15)
Lack of cultural emphasis on mathematics	-	2.01 (9)

Teachers were also asked about the types of interventions currently used for students who are not at grade level and display problem behavior. Their response choices were those that focused on academics, behavior, or both behavior and academics. (See table 15 for results). The differences in ratings between groups were significant based on the chi-squared (2 x 3) for independent samples test.

Table 15

Intervention Selections for Students with Problem Behavior

Intervention Type	Mathematics		Special Education	
	n	%	n	%
Academic	18	6.02	4	2.07
Behavior	16	5.35	22	11.40
Both Academic & Behavior	265	88.63	167	86.53
	X^2 (2, 492) = 9.70, p<0.0078*			

*Denotes significance

Teachers were also asked if they think students must behave appropriately before accessing the curriculum and if students need to achieve mastery of basic skills prior to learning more complex "higher-level" concepts and procedures. Response percentages were similar for both groups and differences were not significant for either question. There were 80 (41.45%) special education teachers and 141 (47.16%) mathematics teachers who felt students must behave appropriately prior to accessing the curriculum. For mastery of basic skills prior to learning more complex mathematics concepts, 131 (58.55%) special education teachers and 195 (65.22%) mathematics teachers indicated yes, it is a critical pre-requisite.

Teachers were also asked to rate the top "teacher factors" that have the greatest potential negative impact on the outcomes for student with behavioral challenges. Special education teachers top five responses were: (1) inadequate training on dealing with student with behavioral challenges, (2) having too many required standards, (3) classes having too many students with IEPs and/or behavioral challenges, (4) inadequate training on dealing with student with disabilities, and (5) lack of instructional planning time (see Table 16). For mathematics teachers the top five responses were: (1) class size, (2) too many required standards, (3) classes having too many students with IEPs and/or behavioral challenges, (4) inadequate training on dealing with student with behavioral challenges, and (5) lack of instructional planning time. While there were differences in over all responses, the largest numbers of both mathematics and special education teachers agreed on four of their top five barriers. A major difference was the highest rating of class size by mathematics teachers, but this is not surprising given the challenges of large class sizes general education teachers are faced with.

Table 16

Teacher Barrier Factors That Negatively Impact Outcomes

Impact Factors	Special Education	Mathematics
	% (Rank)	% (Rank)
Inadequate training on dealing with students with behavioral challenges	21.76 (1)	12.37 (2)
Too many standards required in too short a time period	17.62 (2)	15.05 (3)
Classes having too many students with IEPs and/or behavioral challenges to handle	9.84 (3)	14.72 (4)
Lack of instructional planning time	8.29 (5)	10.70 (5)
Inadequate training on dealing with student with disabilities	8.29 (5)	6.02 (7)
Inadequate training on mathematics instruction	7.25 (6)	7.36 (6)
Class size	6.74 (7)	19.06 (1)
Lack of instructional materials	5.70 (8)	2.01 (10)
Lack of resources	4.66 (9)	3.34 (9)
Mixed messages on instructional approaches from DESE, NCTM, district, research, etc	2.59 (10)	1.00 (13)
Lack of teacher collaboration	2.07 (11)	1.34 (12)
Lack of assistance from other professionals	1.55 (13)	0.67 (14)
Lack of assistance from paraprofessionals	1.55 (13)	-
Lack of assistance from administrators	1.04 (15)	4.68 (8)
Lack of professional development focused on mathematics	1.04 (15)	1.67 (11)

The final question teachers were asked was "Overall, what area do you think has the biggest impact on outcomes for student with behavioral challenges?" The majority of both special education and mathematics teachers reported student challenges as having the greatest impact (see Table 17). When responses were rank ordered, both teacher groups agreed across the board. Those who selected "other" reasons included "lack of parental/home involvement" (4 special education, 10 mathematics) and "lack of relationships with teachers/adults" (3 special education, 2 mathematics).

Table 17

Ratings for Biggest Impact on Outcomes for Students with Behavioral Challenges

	Special Education	Mathematics	Total
	n (%)	n (%)	n (%)
Student challenges (i.e. behavioral challenges, academic difficulties)	128 (66.32)	173 (57.86)	301 (61.18)
Systems issues (i.e. class size, lack of resources, planning issues)	38 (19.69)	88 (29.43)	126 (25.61)
Problems with teacher preparation (i.e.. lack of teacher knowledge, inadequate professional development)	18 (9.33)	25 (8.36)	43 (8.74)
Other (please specify)	9 (4.66)	13 (4.35)	22 (4.47)

CHAPTER IV

DISCUSSION

Overview

The purpose of this study was to explore mathematics instruction for middle school student with and at-risk for EBD. Specifically, through a teacher survey, it was designed to (a) investigate the qualifications and training of those teaching mathematics to students with and at-risk for EBD, (b) examine whether teachers provide access to the recommended curriculum standards, and (c) examine the instructional practices being implemented by teachers in general education mathematics and special education classrooms for students with challenging problem behavior.

The overall response rate (31.39%) was lower than the ideal 50 percent (Fowler, 2009; Nardi, 2006) but consistent with previous studies of its kind (e.g., Gagnon & Maccini, 2007; van Garderen, 2008). The final number of surveys that were complete and acceptable for analysis resulted in a 20.79% response rate for mathematics teachers (n = 299) and a 15.7% response rate for special education teachers (n = 193) equaling a total of 492 responses. These numbers exceeded the minimum needed for data analysis per the a priori power analysis. Low response rates are common for online surveys and email surveys typically produce lower response rates than traditional mail surveys, often in the range of 5-20% (Fowler, 2009; Granello & Wheaton, 2004). Online surveys with email invitations may have lower response rates but they are cost effective and response time is increased compared with more traditional surveys (Granello & Wheaton, Nardi, 2006; Sue & Ritter, 2007). So there is a tradeoff for response rate with lowered cost. Only fully complete surveys were included in the data analysis, leaving 358 partial responses unanalyzed. While the survey took a reasonable amount of time to complete (approximately 15 minutes), it is possible that many of the incomplete teachers' responses remained incomplete due to time restraints or interruptions. The remainder of this chapter discusses results by research question, followed by limitations and implications for practice and future.

Research Question 1

Who is teaching mathematics to middle school students with and at-risk for EBD

Based on the data, the average age of mathematics teachers was 40 years and 43.58 years for special education teachers with the majority of all teachers being female demographics commonly found in the field as well as past research (Gagnon & Maccini, 2007; Maccini & Gagnon, 2002, 2006; van Garderen, 2008). There were no significant differences in years of teaching experience or level of education between teacher groups with the majority of both mathematics and special education teachers holding master's degrees. The experience and level of education findings are also consistent with previous similar survey studies (Maccini & Gagnon, 2002, 2006; van Garderen, 2008). Differences did exist in types of teaching certifications between groups but they were not surprising. Mathematics teachers were more likely to hold general education certifications and special education teachers more likely to hold special education certifications.

The most common special educator credentials held were cross-categorical and mild/moderate disabilities. A majority of teachers held cross-categorical certification (n = 109, 56.5%) while only 16% of special education teachers indicated having behavior disorders/emotional disturbance certifications. Very few mathematics teachers (5.69%)

held special education credentials of any kind while close to half (48.2%) of the special education teachers held an additional general education certificate for elementary education and this is similar to the findings of Maccini & Gagnon (2006). Surprisingly, only one mathematics and three special education teachers surveyed held emergency or temporary credentials. On a positive note, the present study found that 98.45 percent of special education teachers and 99.33 percent of mathematics teachers were fully certified, a surprising outcome given the continued critical shortages in special education and mathematics (Boe & Cook, 2006; Grier & Johnston, 2009; Quigney, 2010).

With regard to training, the majority of both groups of teachers have taken mathematics instructional methods courses. Given the complexity of mathematics curriculum recommendations, it is encouraging that a large majority of teachers, both mathematics and special education, have had methods courses specific to mathematics instructional methods. As part of Missouri's certification requirements, teacher preparation programs must include a mathematics instructional methods course for special education teachers. Despite this requirement, it is alarming to note that 14% of mathematics teachers reported having no formal instructional methods coursework specific to mathematics yet almost all held certifications qualifying them to teach middle school mathematics. This discrepancy may be a result of alternative certification routes, such as certification examinations, or teachers transferring certifications from other states with differing course requirements.

Unfortunately, only half of mathematics teachers have completed special education instructional methods courses. Course work specific to special education mathematics shows a larger gap with only a quarter of mathematics teachers having completed some coursework in this area compared with three-quarters of special education teachers. Similar to Gagnon and colleagues, the results of this survey continue to show that only a small set of mathematics teachers have completed related special education mathematics coursework (Gagnon & Maccini, 2007; Maccini & Gagnon, 2002). These figures are concerning given that the majority of students on IEPs continue to receive most of their instruction within general education classrooms. The number of special education teachers who reported completion of methods courses specific to mathematics were also disappointing considering that all the teachers surveyed reported they were teaching mathematics.

Teachers differed significantly on the location of their instruction with the majority of mathematics teachers instructing by themselves in a general education setting while special education teachers were most likely to instruct in a self-contained or resource room setting. When teacher responses fell into the "other" category, they were asked to provide specifics about the settings in which they taught. Mathematics teacher responses included: Response to Intervention (RtI), "second-dose" of instruction, Title1, and in an at-risk class. The special education teacher responses included: Title1, "second-dose," and currently not teaching mathematics. The good news is that students with challenging behavior are also being instructed in collaborative general education settings where both teacher groups had fair percentage that selected collaborative setting as their place of instruction.

Overall, results indicate that teachers surveyed were fully certified to teach their respective populations of students. In addition, both groups reported taking some coursework relative to the others specialization. Special education teachers are largely qualified to teach mathematics based on their mathematics instructional methods course completion. But half of the surveyed mathematics teachers would not be qualified to teach special education, even within the general education environment, as they have not taken special education methods coursework.

Research Question 2

Are there mathematics curriculum implementation differences between mathematics and special education teachers?

Teachers were first asked questions to determine their awareness and usage of principles and guidelines for middle school mathematics instruction. Mathematics and special education teachers differed significantly in their awareness of the NCTM Principles and Standards and Curriculum Focal Points with the majority of mathematics teachers being aware of both. Just over half of special educators reported being aware of the NCTM Principles and Standards and two-thirds of special educators lacked awareness of NCTM curriculum. This unfortunately is not a recent issue as Maccini and Gagnon, (2002) found a similar lack of awareness over 10 year ago.

Of all teachers surveyed only three mathematics teachers were unfamiliar with the Missouri GLEs. Missouri GLEs were also the most common guidelines cited by both groups of teachers for planning instruction. Indirectly this indicates that teachers are implementing curriculum based on the NCTM Principles and Standards and the NCTM Curriculum Focal Points given that the Missouri GLEs incorporate NCTM recommendations (Bryant et al., 2006; Maccini et al., 2008). The second most common guidelines used were local or building level curricula. It is hopeful that these curriculum guidelines are also based on the Missouri GLEs and NCTM focal points but it could not be determined through the current data set.

Teachers were asked to rate their usage of twenty-four areas of mathematics related curriculum for grades 6-8. The overall mean usage rating across the twenty-four areas was midway between monthly and weekly for mathematics teachers and closer to just monthly for special education teachers. Twelve individual areas of curriculum also differed significantly with mathematics teachers' frequency usage rating being higher than special educators across the board. In fact, mathematics teachers rated usage higher than special education teachers in all but two of twenty-four areas, the exceptions being "the use of probability to make predictions" and "development/evaluation of mathematical proof." This unusual difference in two fairly complex areas of curriculum could indicate that mathematics and special education teachers interpreted the definitions of these two items differently. For example, because it is highly unlikely for middle school special educators to be using mathematical proof more often than mathematics teachers, perhaps special education teachers were not exactly sure what mathematical proofs were, at least as defined by the NCTM. Likewise, one would expect mathematics teachers to report higher rates of usage given the middle school teachers surveyed focused the majority of their instruction exclusively to math.

Statistical differences aside, teachers were in agreement in several areas. The least implemented curriculum recommendations were the same for both mathematics teachers and special education teachers. Low usage ratings (averaging slightly higher than rarely), were noted for "development and evaluation of mathematical proof" and "using various methods of proof." These were also the two areas of curriculum that a large number of both mathematics (n = 79, n = 85) and special education teachers (n = 41,n = 44) indicated as ‘non-applicable’ or ‘do not teach this area’. Ratings were also below ‘sometimes/monthly’ for “use of theoretical probability” and “analysis of figures using distance and angles.” Low ratings across the board in these areas indicate that perhaps these curricular focal points are either too advanced for middle school students or not being addressed until late in middle school and therefore respondent teachers who teach sixth or seventh grade wouldn’t report high usage ratings.

It is encouraging that the highest frequencies of implementation areas for special educators and mathematics teachers were “fluency with and understanding of multiplication and division” and “strategy use for problem solving.” “Proficiency with mathematical operations” and “effective problem solving” are both emphasized benchmark recommendations from the NMAP (2008) and similar to previous findings by van Garderen (2008). Both groups of teachers averaged more than weekly use ratings in these categories. Ideally, high usage should translate to more practice time for students to become proficient in their use of mathematical operations and effective problem solvers.

Usage results indicate that differences in implementation do exist with regard to specific areas. And while mathematics teachers engage in all noted strategies with higher frequency, special education teachers are implementing the same areas of curriculum. For the most part usage for both groups was reported as fairly high.

When teachers were asked to rate the impact of the same curriculum areas, the aggregated mean scores differed for the two teacher groups. Mathematics mean impact rating was slightly above moderate while special education teachers’ rating was slightly below moderate. The difference was statistically significant indicating that the groups do differ and this difference is a result of the teacher category they belong to and not by chance. But the mean impact ratings for both groups were in the moderate range and should be viewed as a positive outcome in that teachers are noting student outcomes among high-risk learners. The areas that both groups rated as having the highest impact, (all above 3.28), were: "fluency with and understanding of multiplication and division," "understanding of mathematical operations on rational numbers," "problem-solving," "strategy use for problem-solving," and "the application of mathematics in a variety of outside contexts." Essentially, these are fairly global areas of curriculum that would have a great impact on students outside the classroom in other areas and later in life. It is encouraging that both groups noted these items as key to impact student learning.

Overall, both groups of teachers report implementing the NCTM curriculum focal points, IES and NMAP recommendations (as determined through GLE usage) and general curricular recommendations advocated within the special education literature, with the exception of "developing and using mathematical proofs." If the mathematical proof usage and impact ratings are set aside, mathematics teachers implement most recommendations more frequently and rate their impact as greater when compared with special education teachers but, on average, teachers are implementing these curricula at a minimum of almost monthly across the board. They perceive that all areas of the curriculum have at least a minimal to moderate impact on student outcomes. So while there is room for improvement, it is encouraging to note that teachers appear to be following best-practice recommendations.

Research Question 3

Are there instructional differences in mathematics between mathematics and special education teachers?

Differences in aggregate mean ratings for both groups were significant but indicate overall usage of recommended and evidence-based practices as fairly high, almost weekly. Both mathematics and special educators gave their highest ratings to the three components of instruction that typically comprise "explicit-instruction:" (1) Teacher demonstration and modeling, (2) guided practice, and (3) corrective feedback. There were no significant differences between the teacher groups and mean ratings for all areas indicate that usage is almost daily. Explicit instruction is recommended by the NMAP (2008), IES (Gersten et al., 2009) and literature pertaining to students with EBD (Gagnon & Maccini, 2007; Yell, 2009) so high usage ratings are positive but not surprising given the widespread recommendation from the mathematics and special education fields.

Teachers also indicated high frequency of use for independent practice, which is not a recommended practice but occurs often in classrooms and is certainly a necessary piece of the larger instructional picture (Maccini & Gagnon, 2006). The six non-recommendations did not yield any major discrepancies when compared to the recommended practices. With regard to the twenty-one practices that had statistically significant differences between the groups, only two had higher mean implementation ratings by mathematics teachers and the remaining 19 were used more frequently by special education teachers. The largest differences between groups were in usage of "individualization of materials" and "adjustment of task difficulty." These results are concurrent with the results of Maccini and Gagnon (2006) where special education teachers were more likely to implement accommodations. This is expected given the individualized nature of special education (Lee, Sugai, & Horner, 1999; Yell, 2009).

Questions focusing on behavior management and strategies related to positive behavior supports indicated significant differences between teacher groups, with special education teachers rating their usage as higher than mathematics teachers. However, the ratings from both special education and mathematics teachers averaged above weekly so it should be noted that both groups report that they are implementing elements of positive behavior support strategies.

When asked about specific strategies, both groups gave the lowest usage rating to "cross-age tutoring." Maccini and Gagnon (2006) examined peer tutoring and cross-age tutoring as one variable and found that more than half (63% and 62%) of special education and mathematics teachers reported using one or both. Maccini and Gagnon's results are vastly different from the low ratings and high numbers of dropped responses for "cross-age tutoring." Perhaps in the previous Maccini and Gagnon study teachers were reporting on their use of peer tutoring more so than cross-age tutoring and their results would have been similar to the present study had the variables been separate. A possible reason for the low usage of "cross-age tutoring" may be the nature of middle school groupings into separate classes and closeness of age that perhaps makes cross-age grouping more challenging. However, "peer tutoring" had above monthly ratings from both teacher groups indicating that teachers are implementing this evidence-based practice (Mooney et al., 2004; Ryan et al., 2004).

The responses for "graduated" and "cover copy compare" instruction elicited the highest, number of 'not-familiar' responses; 38 and 19 for mathematics teachers and 15 and 18 for special education teachers respectively. The high numbers of dropped responses combined with low usage ratings for both practices are concerning as both areas are well supported as evidence-based (Cieslar, McLaughlin, & Derby, 2008; Mooney et al., 2005; NMAP, 2008).

The aggregate impact ratings for instructional practices were not significantly different and only twelve individual impact ratings, compared with twenty one usage ratings, had significant differences. Two of the areas relating to explicit instruction that had high ratings for mathematics and special education teachers were "teacher demonstration and modeling" and "guided practice." It is hopeful that high impact ratings for explicit instruction practices indicate teachers' belief in these practices and that this translates to implementation with fidelity in classrooms as explicit instruction is recommended for all students, including those with and at-risk for EBD (Gersten et al., 2009; Hodge et al., 2006; NMAP, 2008).

Mathematics teachers rated both their usage and impact of "ongoing formative assessment to guide instruction" higher than special education teachers. Given the focus in special education on assessment and monitoring progress this seems unusual albeit encouraging that mathematics teachers are using data to drive instructional decision-making.

Additionally, positive behavior support strategies, "use of reinforcement" and "adjusting classroom routines to promote appropriate behavior," recommended in the EBD research literature (Gagnon & Maccini, 2007; Lewis et al., 2004; Yell, 2009), had high perceived impact ratings from both sets of teachers. These outcomes are encouraging since they may indicate that practices grounded in special education research are crossing over to general education settings and are perceived as useful and worthwhile.

This study adds to the current knowledge base in that it was the first to ask and analyze teachers rated frequency of usage and their perceived level of impact on student outcomes. The generally high usage and impact ratings are encouraging given the need for implementation of evidence-based practices in education but there is still much room for improvement.

Teachers of mathematics and special education both reported the "lack of prerequisite skills" and "lack of student effort" as being the top two greatest student factors that negatively impact student outcomes. The high rating of "lack of prerequisite skills" was not surprising given the documented overall poor level of academic achievement among students with and at-risk for EBD (Lane, 2004; Mooney, Denny, & Gunter, 2004; Wagner et al., 2006). The "lack of student effort," due to a variety of related variables, is also a common characteristic among students with EBD (Christle & Yell, 2009; Mooney et al., 2004). These areas undoubtedly impact a student's ability to succeed in the classroom and it is not surprising that there was agreement between the teacher groups.

The majority of both teacher groups indicated use of concurrent academic and behavioral interventions when instructing students with behavioral challenges. This is encouraging, especially from mathematics teachers, as interventions should not be mutually exclusive for students with and at-risk for EBD. The majorities of both teacher groups also indicated that they do not feel that a student must behave appropriately prior to accessing the curriculum. This is a welcome finding given the common misconception that students must behave before academic learning can occur (Lane, 2004; O'Shaughnessy, Lane, Gresham, & Beebe-Frankenberger, 2003).

The majority of teachers also reported that students should have mastered basic skills to allow them to learn more complex mathematics concepts. While it is true that students should obtain certain benchmark skills to participate fully in the general education curriculum of peers (NMAP, 2008), they should not be excluded from instruction of complex concepts solely because of a lack of certain foundational or prerequisite skills. Students who have not mastered basic skills may, and should, still participate in the curriculum with adaptations and accommodations (e.g. use of calculators, additional time, modified assignments) (Christle & Yell, 2009).

Teachers were also asked to rate "teacher factors that have the greatest negative impact on student outcomes." Special education and mathematics teachers were in agreement about two of their top three barrier factors, (a) too many standards and (b) classes having too many student with IEPs and/or behavioral challenges. With the focus on high standards and accountability, that includes high stakes testing, it is almost expected that teachers are inundated, perhaps overwhelmed, with standards that impact instruction and outcomes (Maccini & Gagnon, 2006; Wagner et al., 2006). With regard to "too many IEPs and/or behavioral challenges," special education teachers were likely responding to the idea of too many students with behavioral challenges while mathematics teachers were likely responding to a combination of both large numbers of behavioral challenges and IEP students.

The greatest number of special educators reported the "lack of training to deal with students with behavioral challenges" as the factor they perceived as having the greatest negative impact. This is a concern given the high likelihood that special education teachers will instruct student who have behavioral challenges. Mathematics teachers indicated their number one barrier factor was overall large class size. Factors that negatively impact outcomes for students have not been ranked in the same manner in previous surveys; however, Maccini and Gagnon (2002) examined other barrier factors and found that the lack of administrative support was the least cited barrier for secondary mathematics and special education teachers. The results of this study were similar in that this area was also the least selected by special education teachers and very few mathematics teachers although it was not the overall lowest selection for mathematics teachers.

Teachers were also asked to indicate the area they felt has the overall biggest negative impact on outcomes for student with challenging behavior. The majorities of both teacher groups indicated student challenges (e.g. behavioral challenges, academic difficulties). This is no surprise given that student challenges often inhibit a productive teaching and learning environment (Christle & Yell, 2009; Lane, 2004; Sutherland et al., 2008). Whether the challenges are behavioral or academic, they play a major role in outcomes regardless of the classroom or educational systems in which instruction is occurring.

Limitations

While the results of this survey provide an expansion of the current limited knowledge base, limitations are present. Since data were gathered in a single state, generalization is limited with respect to drawing conclusions across other state systems of education. An inherent limitation of survey research is that data are self-reported and cannot be verified for accuracy. While reliability was ensured with standardized directions and data entry, item analyses were not conducted to determine whether survey questions directly tapped the constructs of the research questions. Additional follow-up interviews and questions would have strengthened the confidence in the accuracy and correct interpretation of the questions.

Implications for Practice

While the findings of this study are preliminary and not without limitations, there are implications for teacher and instructional practices. Results indicate that mathematics teachers are generally more prepared to teach mathematics and special education teachers are generally more prepared to instruct students with disabilities, including students with behavioral disorders. Yet, special and mathematics educators by and large do both. Mathematics teachers would potentially benefit from more training in special education methods, including training specific to instruction of students with behavioral challenges and instructing mathematics to students with disabilities. Likewise, while special educators report having had specific coursework, their overall reported lower rates of recommended curricula and instructional strategies indicates that perhaps additional professional development is warranted. As part of training and professional development, perhaps teachers should receive actual mathematics instruction in addition to instructional methods training given that mathematics content knowledge has a positive impact on academic outcomes for students (NAMP, 2008). Unfortunately, some states do not require mathematics instruction as a part of special education teacher preparation programs (Maccini & Gagnon, 2006).

It is very concerning that Special education teachers report feeling unprepared to deal with behavioral challenges. If the reality is that students who demonstrate significant behavioral challenges spend the majority of their school day in self-contained classrooms (Christle & Yell, 2009), the field must prepare special education teachers to feel competent in handling these behavioral challenges, as they are highly likely to encounter them.

Results found in the present study indicated that a major barrier for middle school students is the "lack of prerequisite skills" and "student challenges." It is recommended that general and special educators work in concert to address skill deficits and to ensure that students with behavioral challenges are kept on track with their peers. Teacher training should focus on how to tailor and accommodate curriculum and instructional practices to ensure access for all students. Across all grade levels, teachers and administrators should be using best practices to prevent and manage problem behavior along with implementation of proven academic strategies in an attempt to keep students engaged and on-track.

Implications for Future Research

Though based on self-reported teacher data, the results of this study highlight that curricula and practices are generally being implemented but there is room for increased usage. Many of the outcomes of this study are consistent with previous research regarding mathematics curricula and instructional practices for students with disabilities at other grade levels (Gagnon & Maccini, 2007; Maccini & Gagnon, 2002, 2006, van

Garderen, 2008). While the current study has contributed to the existing knowledge base, given the unique middle school population, additional research is necessary to draw any major conclusions about mathematics instruction for students with and at-risk for EBD. The limitations and results indicate that additional and different types of investigation are necessary to move practices of mathematics instruction for students with and at-risk for EBD forward.

Additional research is necessary to broaden the scope of the current study to include a larger population and additional data from a larger, perhaps national, sample. Future research might include observation of instructional practices and investigation of curricula being implemented to validate teacher perceptions. More information regarding methods coursework and route to certification should be gathered, coursework and training should be compared to reported implementation of curricula and instructional practices, and professional development should also be examined. It may also be worthwhile to gather data on teachers' perceptions of their own qualifications and preparedness to instruct students with behavioral challenges. The results of this study suggest that teachers are qualified on paper yet are not aware of/or implementing many standards and practice recommendations. How do we ensure that certification truly leads to a highly qualified teacher? The research suggests that teachers' mathematics content knowledge is linked to positive academic outcomes for students. If this is the case, the field should look to improving actual mathematics coursework and education in addition to mathematics teaching methods coursework

Investigation into increasing the implementation of these practices is warranted. Based on these results, recommended practices are being implemented and yet academic outcomes remain mediocre at best for the students with EBD (Lane, 2004; Mattison et al., 2002; Mooney et al., 2004). If recommended practices and curricula are not being disseminated in pre-service or continuing education coursework, is this information being distributed elsewhere? And if not, how does the field ensure this information is disseminated? What other pieces factor into the puzzle related to outcomes? What additional practices would improve outcomes? Finding answers to questions such as: "How do we increase usage of recommendations?" could lead to positive outcomes for students with and at-risk for EBD. Long term, research should examine if the recommended practices are implemented more frequently do outcomes for students with and at-risk for EBD improve?

Conclusion

This study was designed to ascertain who is teaching mathematics to middle school students with and at-risk for EBD, if these teachers implement curriculum and instructional practices grounded in evidence or the field's recommendations, and if there are differences in implementation between mathematics and special educators. The results indicate that the majority of teachers surveyed are qualified to teach, as they are fully certified, and they are aware of most recommendations and are implementing them fairly frequently but not at maximum usage. Special educators are generally not aware of the actual NCTM curriculum commendations but are using curricula that address the same mathematics skills and processes. They are also more likely than mathematics teachers to implement the instructional practice recommendations in the special education, IES, NMAP literature.

Both mathematics and special education teachers rely most on the state standards (GLEs) and IEP goals when planning instruction for students with and at-risk for EBD. This is encouraging since Missouri state standards do parallel many of the NCTM recommendations and standards. However, there seems to be a gap in the ideal level of usage and implementation and the actual (teacher reported) usage and implementation of recommended practices and curricula. The question that yet remains is how do we increase usage of practice recommendations across the board to hopefully improve outcomes for students with and at-risk for EBD?

Appendix A

Mathematics Instruction and Behavioral Challenges

Hello and thank you for taking time out of your busy day to respond to this survey regarding mathematics instruction for students with behavioral challenges. Your responses will help to inform research and instructional practices in mathematics for middle school students with behavioral challenges.

This survey should take approximately 15 minutes to complete. If you provide your email address upon completion of the survey you will be entered in a drawing to win one of 5 $100 gift certificates to Amazon.com

As you are completing the survey questions, please keep in mind students with or at-risk for emotional and behavioral disorders. These students display problem behaviors that impact their academic achievement and social development and includes both internalizing and externalizing types of behavior patterns.

Externalizing behavior problems are directed outward toward the external social environment and include: displaying aggression, arguing, defiance, non-compliance, tantrums, hyperactivity, disturbing others, stealing, and not following rules.

Internalizing behavior problems are directed inward and represent problems with ones self. These include: having low activity levels, not talking with other children, shyness, unassertive, preferring to be alone, non participating in games/activities, unresponsive to social initiations, and avoidance of or withdrawal from social situations.

Keep in mind students who you currently instruct or have previously instructed in mathematics that have demonstrated these types of behavioral challenges.

Do currently or have you in past school years instruct mathematics for students in grades 6, 7, or 8 in either general education or special education?

◯ Yes

◯ No

Comments

Appendix A

Mathematics Instruction and Behavioral Challenges

Are you a mathematics teacher or special education teacher? Please select one. (If you are a special education mathematics teacher please select special education.)

○ Mathematics

○ Special Education

○ Other (please specify)

Are you familiar with the National Council of Teacher of Mathematics (NCTM) Principles and Standards?

○ Yes ○ No

Are you familiar with the NCTM Curriculum Focal Points?

○ Yes ○ No

Are you familiar with the Missouri Grade Level Expectations (GLEs)?

○ Yes ○ No

When planning mathematics instruction for middle school students with behavioral challenges what guidelines do you rely most on?

○ NCTM Curriculum Focal Points ○ Missouri GLEs ○ Textbook guidelines ○ Local Curriculum guidelines

○ Other (please specify)

Appendix A

Mathematics Instruction and Behavioral Challenges

Please indicate on a scale of 1-5 your frequency of emphasis on the following mathematics curricular areas for students with behavioral challenges.

	1 (never)	2 (rarely - a few times per year)	3 (sometimes - monthly)	4 (often - weekly)	5 (daily)	Unfamiliar	N/A to grade level or do not instruct in this area
Fluency with and understanding of multiplication and division							
Connection of ratio/rate with multiplication and division							
Application and understanding of proportionality (using proportionality to solve a variety of problems including discounts, taxes, tips, interest and percentages of increase/decrease)							
Make estimates relating to proportions							
Use theoretical probability and proportion to make predictions (predicting the likelihood of outcomes)							
Understanding of matematical operations on rational numbers							
Use of mathematical expressions and equations (writing and interpreting)							
Solving linear equations and systems of linear equations							
Analyzing and representing linear functions							
Analysis and summarization of data sets							
Using formulas to determine area and volume							
Analysis of two and three-dimensional figures (and space) using distance and angles							
Problem-solving (curricula focuses on "real world" or multi-step problems and the process/steps/means of arriving at a solution)							

Appendix A

Mathematics Instruction and Behavioral Challenges

Building new mathematical knowledge through problem-solving (putting together various mathematics skills to understand larger mathematical concepts)	○	○	○	○	○	○	○
Strategy use for problem-solving	○	○	○	○	○	○	○
Reflection on the problem-solving process (discussion, self-talk, etc)	○	○	○	○	○	○	○
Development and evaluation of mathematical proof	○	○	○	○	○	○	○
Using various methods of mathematical proof (use of direct proof, negation, mathematical induction, and theorems)	○	○	○	○	○	○	○
Communication of mathematical thinking to others (written and verbal communication of mathematical processes)	○	○	○	○	○	○	○
Analyze the mathematical thinking of others (i.e. evaluating the mathematical steps another student used to solve a problem)	○	○	○	○	○	○	○
Organization and use of mathematical thinking (emphasizing mathematical processes/concepts and how to gather information, organize, and solve mathematical problems)	○	○	○	○	○	○	○
Recognition and use of connections between mathematical ideas	○	○	○	○	○	○	○
Applying mathematics in outside contexts (using a variety of examples, including real world, to ensure student are able to utilize mathematics knowledge outside the curricula)	○	○	○	○	○	○	○
Creating representation to organize, record, and communicate mathematics (visual, pictorial, diagrams, stories, etc)	○	○	○	○	○	○	○

Appendix A

Mathematics Instruction and Behavioral Challenges

Based on the same areas of curricular focus, please indicate the level of impact each has on the mathematics achievement of students with behavioral challenges.

	1 (no impact)	2 (minimal impact)	3 (moderate impact)	4 (strong impact)	Unfamiliar	N/A to grade level or do not instruct in this area
Fluency with and understanding of multiplication and division	○	○	○	○	○	○
Connection of ratio/rate with multiplication and division	○	○	○	○	○	○
Application and understanding of proportionality (using proportionality to solve a variety of problems including discounts, taxes, tips, interest and percentages of increase/decrease)	○	○	○	○	○	○
Make estimates relating to proportions	○	○	○	○	○	○
Use theoretical probability and proportion to make predictions (predicting the likelihood of outcomes)	○	○	○	○	○	○
Understanding of matematical operations on rational numbers	○	○	○	○	○	○
Use of mathematical expressions and equations (writing and interpreting)	○	○	○	○	○	○
Solving linear equations and systems of linear equations	○	○	○	○	○	○
Analyzing and representing linear functions	○	○	○	○	○	○
Analysis and summarization of data sets	○	○	○	○	○	○
Using formulas to determine area and volume	○	○	○	○	○	○
Analysis of two and three-dimensional figures (and space) using distance and angles	○	○	○	○	○	○
Problem-solving (curricula focuses on "real world" or multi-step problems and the process/steps/means of arriving at a solution)	○	○	○	○	○	○

Appendix A

Mathematics Instruction and Behavioral Challenges

Building new mathematical knowledge through problem-solving (putting together various mathematics skills to understand larger mathematical concepts)	○	○	○	○	○	○
Strategy use for problem-solving	○	○	○	○	○	○
Reflection on the problem-solving process (discussion, self-talk, etc)	○	○	○	○	○	○
Development and evaluation of mathematical proof	○	○	○	○	○	○
Using various methods of mathematical proof (use of direct proof, negation, mathematical induction, and theorems)	○	○	○	○	○	○
Communication of mathematical thinking to others (written and verbal communication of mathematical processes)	○	○	○	○	○	○
Analyze the mathematical thinking of others (i.e. evaluating the mathematical steps another student used to solve a problem)	○	○	○	○	○	○
Organization and use of mathematical thinking (emphasizing mathematical processes/concepts and how to gather information, organize, and solve mathematical problems)	○	○	○	○	○	○
Recognition and use of connections between mathematical ideas	○	○	○	○	○	○
Applying mathematics in outside contexts (using a variety of examples, including real world, to ensure student are able to utilize mathematics knowledge outside the curricula)	○	○	○	○	○	○
Creating representation to organize, record, and	○	○	○	○	○	○

Mathematics Instruction and Behavioral Challenges

communicate mathematics (visual, pictorial, diagrams, stories, etc)

Appendix A

Mathematics Instruction and Behavioral Challenges

Please indicate on a scale of 1-5 the extent of your use of the following instructional methods and practices for students with behavioral challenges. Examples and/or definitions are in parentheses following each instructional method.

	1 (never)	2 (rarely - a few times per year)	3 (sometimes - monthly)	4 (often - weekly)	5 (daily)	Not familiar
Teacher demonstration and modeling						
Guided practice (teacher "walks" or guides students through steps of problem solving to find a solution)						
Corrective Feedback (teacher gives student feedback indicating any issues with understanding or mastery of concepts and procedures)						
Providing time for student verbalization (think aloud: verbally processing through steps of task)						
Independent Practice						
Providing multiple opportunities to respond (OTRs)						
Use of ongoing formative assessment to guide instruction						
Use of problems with scenarios that may occur in "real world" situations						
Use of problems that are relevant to each student						
Instruction in word problem structure (i.e. different types of word problems and how to distinguish relevant and superficial information						
Use of visual representations for modeling (drawings, pictures, diagrams, etc.)						
Directing student to use visual representations (students create their own drawing, picture, diagram, etc.)						
Use of manipulatives (tangible objects to represent example and process task)						
Use of graduated instruction or C-S-A (concrete, semi-concrete, abstract {use of tangibles, then representations of the tangible, and finally moving to the use of written numbers})						
Technology for instruction (computer instructional software used to present new material)						
Technology for practice or review (i.e. drill and practice software used after teacher instruction of concepts)						

Mathematics Instruction and Behavioral Challenges

Fast fact practice (dedicated time ((i.e. a few minutes)) to do fast facts	◯	◯	◯	◯	◯	◯
Flash cards	◯	◯	◯	◯	◯	◯
Foundational skills practice and review	◯	◯	◯	◯	◯	◯
Peer tutoring (students, typically of varying abilities, are paired together to learn new material or practice academic tasks...students assume both roles of tutor and tutee)	◯	◯	◯	◯	◯	◯
Cross-age tutoring (older and younger students paired or grouped together to teach, learn, and practice mathematical concepts)	◯	◯	◯	◯	◯	◯
Small group instruction (teacher led)	◯	◯	◯	◯	◯	◯
Small group work (students working together)	◯	◯	◯	◯	◯	◯
Use of published curriculum or district adopted curriculum as it is presented	◯	◯	◯	◯	◯	◯
Individualization of materials (instructional materials are selected for individual students based on ability and current level of skill)	◯	◯	◯	◯	◯	◯
Adjusting task difficulty (a single task is adjusted based on ability...multiple students may work on the same task but some students may only do portions of the task or a less complex version of the task)	◯	◯	◯	◯	◯	◯
Selection of ability appropriate lessons and/or curricula	◯	◯	◯	◯	◯	◯
Providing additional time and opportunities for practice	◯	◯	◯	◯	◯	◯
Reduction of workload	◯	◯	◯	◯	◯	◯
Graphic organizers (diagrams used to assist in the decision making, structuring, and solving of problems.)	◯	◯	◯	◯	◯	◯
Strategy training (i.e. strategy cue cards: card that walk through steps of problem solving or that give student guidance through a task)	◯	◯	◯	◯	◯	◯
Setting up self-management or self-monitoring programs (students are given responsibility to monitor and assess academic and/or behavioral engagement...i.e. students may manage their academic behavior by using a checklist to complete a series of steps in a problem OR students may use a similar checklist/chart to monitor on- or off-task behavior)	◯	◯	◯	◯	◯	◯
Instruction in self-talk (students are explicitly instructed in how to use self-talk (think aloud) strategies to solve mathematics problems)	◯	◯	◯	◯	◯	◯

Appendix A

Mathematics Instruction and Behavioral Challenges

Cover Copy Compare (students are given a completed example of a problem, directed to cover the solution and "work," copy the problem, solve, and compare their solution and "work" with the correct example)	○	○	○	○	○	○
Mnemonic Devices (learning strategy that assists in memory; commonly words or poems that help student remember the steps or stages of solving a particular type of problem in mathematics)	○	○	○	○	○	○
Use of reinforcement for appropriate behavior	○	○	○	○	○	○
Correction of undesirable behavior	○	○	○	○	○	○
Maintaining or adjusting classroom management to better suit particular students	○	○	○	○	○	○
Adjusting classroom routines to encourage and promote appropriate behavior	○	○	○	○	○	○

Appendix A

Mathematics Instruction and Behavioral Challenges

Please rate the impact and effectiveness of the same instructional practices.

	1 (no impact/does not influence academic outcomes)	2 (minimal impact)	3 (moderate impact)	4 (strong impact/results in positive outcomes)	Unfamiliar	No opinion
Teacher demonstration and modeling	◯	◯	◯	◯	◯	◯
Guided practice	◯	◯	◯	◯	◯	◯
Corrective Feedback	◯	◯	◯	◯	◯	◯
Providing time for student verbalization	◯	◯	◯	◯	◯	◯
Independent Practice	◯	◯	◯	◯	◯	◯
Providing multiple opportunities to respond (OTRs)	◯	◯	◯	◯	◯	◯
Use of ongoing formative assessment to guide instruction	◯	◯	◯	◯	◯	◯
Use of problems with scenarios that may occur in "real world" situations	◯	◯	◯	◯	◯	◯
Use of problems that are relevant to each student	◯	◯	◯	◯	◯	◯
Instruction in word problem structure	◯	◯	◯	◯	◯	◯
Use of visual representations for modeling	◯	◯	◯	◯	◯	◯
Directing student to use visual representations	◯	◯	◯	◯	◯	◯
Use of manipulatives	◯	◯	◯	◯	◯	◯
Use of graduated instruction or C-S-A	◯	◯	◯	◯	◯	◯
Technology for instruction	◯	◯	◯	◯	◯	◯
Technology for practice or review	◯	◯	◯	◯	◯	◯
Fast fact practice	◯	◯	◯	◯	◯	◯
Foundational skills practice and review	◯	◯	◯	◯	◯	◯
Peer tutoring	◯	◯	◯	◯	◯	◯
Cross-age tutoring	◯	◯	◯	◯	◯	◯
Small group instruction	◯	◯	◯	◯	◯	◯
Small group work	◯	◯	◯	◯	◯	◯
Use of published curriculum or district adopted	◯	◯	◯	◯	◯	◯

Mathematics Instruction and Behavioral Challenges

curriculum as it is presented						
Individualization of materials	○	○	○	○	○	○
Adjusting task difficulty	○	○	○	○	○	○
Selection of ability appropriate lessons and/or curricula	○	○	○	○	○	○
Providing additional time and opportunities for practice	○	○	○	○	○	○
Reduction of workload	○	○	○	○	○	○
Graphic organizers	○	○	○	○	○	○
Strategy training	○	○	○	○	○	○
Setting up self-management or self-monitoring programs	○	○	○	○	○	○
Instruction in self-talk (students are explicitly instructed in how to use self-talk (think aloud) strategies to solve mathematics problems)	○	○	○	○	○	○
Cover Copy Compare	○	○	○	○	○	○
Mnemonic Devices	○	○	○	○	○	○
Use of reinforcement for appropriate behavior	○	○	○	○	○	○
Correction of undesirable behavior	○	○	○	○	○	○
Maintaining or adjusting classroom management to better suit particular students	○	○	○	○	○	○
Adjusting classroom routines to encourage and promote appropriate behavior	○	○	○	○	○	○

Appendix A

Mathematics Instruction and Behavioral Challenges

Please rank order the top 5 factors that you believe have the greatest negative impact on the outcomes for students with behavioral challenges in mathematics. 1 = the single greatest negative impact factor.

	1 (Greatest)	2	3	4	5
Lack of student prerequisite skills	○	○	○	○	○
Lack of participation	○	○	○	○	○
Lack of effort	○	○	○	○	○
Lack of study skills and work habits (including organizational skills)	○	○	○	○	○
Inability to process content	○	○	○	○	○
Students enrolled in inappropriate level of course (perhaps due to pending high school prerequisites)	○	○	○	○	○
Externalizing behavior patterns (defiance, opposition, etc)	○	○	○	○	○
Internalizing behavior patterns (withdrawal, anxiety, etc)	○	○	○	○	○
Inability to work independently	○	○	○	○	○
Disinterest in subject matter	○	○	○	○	○
Lack of cultural emphasis on mathematics	○	○	○	○	○
Unprepared	○	○	○	○	○
Lack of relationship with peers	○	○	○	○	○
Lack of relationship with adults/teachers	○	○	○	○	○
Absenteeism	○	○	○	○	○

Additional Comments

Mathematics Instruction and Behavioral Challenges

When instructing a student who is not at grade level and displays problem behavior do you use interventions that are focused on (a) academics, (b) behavior, or (c) both behavior and academics?

- ◯ (a) academics
- ◯ (b) behavior
- ◯ (c) behavior and academics

Must students behave appropriately before accessing the mathematics curriculum?

- ◯ Yes
- ◯ No

Do students need to achieve mastery of basic skills prior to learning more complex instruction of "higher-level" concepts and procedures?

- ◯ Yes
- ◯ No

Appendix A

Mathematics Instruction and Behavioral Challenges

Please rank order the top 5 teacher factors that have the greatest negative impact on the outcomes for students with behavioral challenges. 1 = greatest negative impact.

	1 Greatest	2	3	4	5
Lack of instructional materials	○	○	○	○	○
Lack of resources	○	○	○	○	○
Inadequate training on mathematics instruction (lack of prerequisite teaching skills)	○	○	○	○	○
Lack of professional development focused on mathematics	○	○	○	○	○
Inadequate training on dealing with students with disabilities	○	○	○	○	○
Inadequate training on dealing with students with behavioral challenges	○	○	○	○	○
Lack of assistance from other professionals (i.e. teachers, specialists)	○	○	○	○	○
Lack of assistance from administrators	○	○	○	○	○
Lack of assistance from paraprofessionals	○	○	○	○	○
Lack of instructional planning time (time used to actually plan...not for class coverage, meetings, etc)	○	○	○	○	○
Lack of teacher collaboration	○	○	○	○	○
Class size	○	○	○	○	○
Classes having too many students with IEPs and/or behavioral challenges to handle	○	○	○	○	○
Mixed messages on instructional approaches from DESE, NCTM, district, research, etc	○	○	○	○	○
Too many standards required in too short a time period	○	○	○	○	○

Additonal Comments

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Appendix A

Ma

Overall, what area do you think has the biggest impact on outcomes for students with behavioral challenges?

Appendix A

Mathematics Instruction and Behavioral Challenges

Gender

- [ ] Male
- [ ] Female

Your age

[ ]

Highest completed education level

- ( ) Bachelors
- ( ) Masters
- ( ) Specialist
- ( ) Doctorate

Areas of Study

[ ]

Certifications held

- [ ] Elementary Education
- [ ] Secondary Mathematics
- [ ] Cross-Categorical Special Education
- [ ] Behavior Disorders/ED
- [ ] Learning Disabilities
- [ ] Mild/Moderate Special Education
- [ ] Moderate/Severe Special Education
- [ ] Temporary or Emergency Credential

Other (please specify)

[ ]

Appendix A

Mathematics Instruction and Behavioral Challenges

Area(s) in which you currently instruct

- [ ] Mathematics
- [ ] Special Education
- [ ] Special Education Mathematics

Other (please specify)

Areas of teaching experience (previous school years)

- [ ] Mathematics
- [ ] Special Education
- [ ] Special Education Mathematics

Other (please specify)

Years of Teaching Experience

Have you taken mathematics instructional methods courses?

- ( ) Yes
- ( ) No

If so, how many?

Have you taken special education instructional methods courses?

- ( ) Yes
- ( ) No

If so, how many?

Mathematics Instruction and Behavioral Challenges

Where any of these courses specific to instructing mathematics to special education courses?

- ◯ Yes
- ◯ No

Where do you currently instruct mathematics?

- ☐ General Education
- ☐ Collaborative Instructional setting in a general education classroom (i.e. co-teaching or class within a class)
- ☐ Inclusion Classroom (non co-teaching)
- ☐ Resource Classroom
- ☐ Self contained special education classroom
- ☐ Other (please specify)

Appendix A

Mathematics Instruction and Behavioral Challenges

Thank you very much for your time. To be entered in the drawing for Amazon.com gift certificates please enter your name and email address. (All contact information will be confidential and only used to select winners.)

Name

Email

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Appendix B

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Mathematics Instruction and Behavioral Challenges

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To: [Email]
From: "sejt24@mail.missouri.edu via surveymonkey.com" <member@surveymonkey.com>

Subject: Behavioral Challenges and Mathematics Instruction Survey
Body: Hello Missouri Teacher!

My name is Stacey Jones and I am a PhD student in Special Education at the University of Missouri. I am contacting you because according to the Missouri DESE database you are a teacher of 6, 7, or 8th grade in either mathematics or special education.

I am conducting a survey study focused on instructional practices in mathematics for students with and at-risk for behavior disorders. I believe you may be able to help with my research!

The survey will take approximately 10-15 minutes of your time and if you complete it and leave your email address, you will be entered to win one of five $100 e-gift cards to Amazon.com!

Here is a link to the survey:
https://www.surveymonkey.com/s.aspx

(This link is uniquely tied to this survey and your email address so, please do not forward this message.)

If you have any questions or need assistance in anyway please do not hesitate to contact me.

Research is a very important piece of improving educational practices and your opinions are incredibly valuable! Thanks very much for your participation!

Cheers,
Stacey Jones
sejt24@mail.missouri.edu

Please note: If you do not or have not instructed mathematics you can click the link below, and you will be removed from the mailing list.
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To: [Email]
From: "staceyeljones@gmail.com via surveymonkey.com" <member@surveymonkey.com>

Subject: Behavior and Mathematics Survey Reminder!
Body: Hello again Missouri teacher! This is Stacey Jones again...the PhD student from the University of Missouri. I'm writing again to ask/remind you to take a few minutes of your busy day to fill out a quick survey regarding mathematics instruction and behavioral challenges.

Here is a link to the survey:
https://www.surveymonkey.com/s.aspx

(This link is uniquely tied to this survey and your email address so, please do not forward this message.)

Don't forget, if you complete it and leave your email address you will be entered to win one of five $100 e-gift cards to Amazon.com!

If you have any questions or need assistance please do not hesitate to contact me. Thanks for your participation!

Cheers,
Stacey Jones
sejt24@mail.missouri.edu

Please note: If you do not or have not instructed mathematics you can click the link below, and you will be removed from the mailing list.
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To: [Email]
From: "sejt24@mail.missouri.edu via surveymonkey.com" <member@surveymonkey.com>

Subject: Mathematics Instruction Survey...Last Chance!
Body: Greetings Missouri teacher!

This is Stacey Jones, the PhD student from the University of Missouri...again!

I am bothering you one last time to take a few minutes of your busy day to fill out a quick survey regarding mathematics instruction and behavioral challenges and be entered to win one of five $100 Amazon e-gift cards.

I realize that this is a hectic time of year but the survey is part of my dissertation research to complete my PhD in Special Education and I would really appreciate your help in responding! The survey should take between 10 and 15 minutes to finish. (I realize it looks long but I promise it isn't that bad!)

Here is the link to it:

https://www.surveymonkey.com/s.aspx

(This link is uniquely tied to this survey and your email address so, please do not forward this message. If you know of anyone else who would be an appropriate responder you can email me their information.)

If you have any questions or need assistance please do not hesitate to contact me. Thanks for your participation! Happy Holidays!

Smiles~

Stacey Jones
sejt24@mail.missouri.edu

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To: [Email]
From: "staceyeljones@gmail.com via surveymonkey.com" <member@surveymonkey.com>

Subject: Mathematics Instruction Survey...come back and finish!
Body: Greetings Missouri Teacher!

This is Stacey Jones, the PhD student from the University of Missouri...again!

I am bothering you to take a few extra minutes of your busy day to return to the survey regarding mathematics instruction and behavioral challenges that you started but did not complete.

I realize that this is a hectic time of year, but the survey is part of my dissertation research to complete my PhD in Special Education and I would really appreciate your help in responding! The survey should take between 10 and 15 minutes to finish. (Perhaps the last time you sat down it seemed daunting or you were interrupted.)
I realize it looks long but I promise it isn't that bad!

Here's another link to it:
https://www.surveymonkey.com/s.aspx

(This link is uniquely tied to this survey and your email address so, please do not forward this message. If you know of anyone else who would be an appropriate responder you can email me their information.)

Don't forget if you complete it you will be entered to win one of five $100 Amazon e-gift cards.

Your help is MUCH appreciated. If you have any questions or need assistance please do not hesitate to contact me. Thanks for your participation. Happy Holidays!

Smiles~

Stacey Jones
sejt24@mail.missouri.edu

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The message mailed to **1923** recipient(s). View

Message Preview

Below is a preview of your message based on the first recipient in your list ([Email]).

To: [Email]
From: "sejt24@mail.missouri.edu via surveymonkey.com" <member@surveymonkey.com>

Subject: Help with PhD Survey...One more chance!
Body: Happy New Year Missouri Mathematics and Special Education Teachers.

This is Stacey Jones, the PhD student from the University of Missouri bothering you for the last time.

I am reminding you, just once more, to take a few minutes of your busy day to fill out a quick survey regarding mathematics instruction and behavioral challenges and be entered to win one of five $100 Amazon e-gift cards.

I realize that you are all incredibly busy, but your help would be valuable to both myself and the field of middle school education. The survey is part of my dissertation research to complete my PhD in Special Education and I would really appreciate your help in responding! The survey should take between 10 and 15 minutes to finish. (I realize it looks long but I promise it isn't that bad!)

Here is the link to it:

https://www.surveymonkey.com/s.aspx

(This link is uniquely tied to this survey and your email address so, please do not forward this message. If you know of anyone else who would be an appropriate responder you can email me their information.)

If you have any questions or need assistance please do not hesitate to contact me. Thanks for your participation!

Smiles~

Stacey Jones
sejt24@mail.missouri.edu

Please note: If you do not or have not instructed mathematics you can click the link below, and you will be removed from the mailing list.

https://www.surveymonkey.com/optout.aspx

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Appendix G

staceyjones Sign Out Help

Home My Surveys Survey Services Plans & Pricing + Create Survey

Mathematics Instruction and Behavioral Challenges

Design Survey | Collect Responses | Analyze Results

View Summary
Edit Recipients
Edit Messages
Change Settings
Rewards
Change Restrictions
Open Collector Now

Emails Edit

Email Invitation CLOSED

Message Summary

« Back to Messages List

Message Delivery Schedule

Delivery completed on January 17, 2012 6:01 AM.

Message Recipients

The message mailed to **80** recipient(s). View

Message Preview

Below is a preview of your message based on the first recipient in your list ([Email]).

To: [Email]
From: "sejt24@mail.missouri.edu via surveymonkey.com" <member@surveymonkey.com>

Subject: Mathematics Instructional Practices Survey
Body: Hello Lee's Summit Math or Special Education Teacher!

My name is Stacey Jones and I am a PhD student in Special Education at the University of Missouri. I am contacting you because according to the Missouri DESE database you are a teacher of 6, 7, or 8th grade in either mathematics or special education.

I am conducting a survey study focused on instructional practices in mathematics for students with and at-risk for behavior disorders. I believe you may be able to help with my research!

The survey will take approximately 10-15 minutes of your time. If you complete it and leave your email address, you will be entered to win one of five $100 e-gift cards to Amazon.com!

Here is a link to the survey:
https://www.surveymonkey.com/s.aspx

(This link is uniquely tied to this survey and your email address so, please do not forward this message.)

If you have any questions or need assistance in anyway please do not hesitate to contact me.

Research is a very important piece of improving educational practices and your opinions are incredibly valuable! Thanks very much for your participation!

Cheers,
Stacey Jones
sejt24@mail.missouri.edu

Please note: If you do not or have not instructed mathematics you can click the link below, and you will be removed from the mailing list.
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Appendix H

Table A

Dropped Reponses for Implementation of NCTM Curricular Recommendations by Teacher Type

Curriculum Recommendation	Teacher Type			
	Special Education		Mathematics	
	Unfamiliar	N/A to grade level or do not instruct in this area	Unfamiliar	N/A to grade level or do not instruct in this area
	n (%)	*n* (%)	*n* (%)	*n* (%)
Fluency with and understanding of multiplication and division	-	12 (6.22)	1 (0.33)	10 (3.34)
Connection of ration/rate with multiplication and division	1 (0.52)	19 (9.84)	-	6 (2.01)
Application and understanding of proportionality	-	19 (9.84)	-	7 (2.34)
Make estimates relating to proportions	1 (0.52)	12 (6.22)	-	11 (3.68)
Use theoretical probability and proportion to make predictions	1 (0.52)	17 (8.81)	1 (0.33)	3 (1.00)
Understanding of mathematical operations on rational numbers	3 (1.55)	9 (4.66)	-	2 (0.67)
Use of mathematical expressions and equations	3 (1.55)	12 (6.22)	1 (0.33)	1 (0.33)
Solving linear equations and systems of linear equations	4 (2.07)	23 (11.91)	-	19 (6.35)
Analyzing and representing linear functions	2 (1.04)	27 (13.99)	-	24 (8.03)
Analysis and summarization of data sets	1 (0.52)	12 (6.22)	1 (0.33)	9 (3.01)

Using formulas to determine area and volume	-	18	1 (0.33)	2 (0.67)
Analysis of two and three-dimensional figures using distance and angles	-	20	1 (0.33)	18 (6.02)
Problem-solving	4 (2.07)	6 (3.12)	2 (0.67)	2 (0.67)
Building new mathematical knowledge through problem-solving	1 (0.52)	7 (3.63)	1 (0.33)	2 (0.67)
Strategy use for problem-solving	3 (1.55)	6 (3.12)	-	1 (0.33)
Reflection on the problem-solving process	2 (1.04)	6 (3.12)	-	1 (0.33)
Development and evaluation of mathematical proof	2 (1.04)	41 (21.24)	2 (0.67)	79 (26.42)
Using various methods of mathematical proof	4 (2.07)	44 (22.80)	3 (1.00)	85 (28.43)
Communication of mathematical thinking to others	3 (1.55)	11 (5.70)	1 (0.33)	1 (0.33)
Analyze the mathematical thinking of others	1 (0.52)	14 (7.25)	1 (0.33)	1 (0.33)
Organization and use of mathematical thinking	2 (1.04)	10 (5.18)	2 (0.67)	1 (0.33)
Recognition and use of connections between mathematical ideas	2 (1.04)	13 (6.74)	6 (2.01)	1 (0.33)
Applying mathematics in outside contexts	3 (1.55)	6 (3.12)	3 (1.00)	1 (0.33)
Creating representation to organize, record, and communicated mathematics	2 (1.04)	7 (3.63)	4 (1.34)	1 (0.33)

Table B

Dropped Responses for Impact Ratings of NCTM Curricular Recommendations

Curriculum Recommendation	Teacher Type			
	Special Education		Mathematics	
	Unfamiliar	N/A to grade level or do not instruct in this area	Unfamiliar	N/A to grade level or do not instruct in this area
	n (%)	*n* (%)	*n* (%)	*n* (%)
Fluency with and understanding of multiplication and division	1 (0.52)	11 (5.70)	1 (0.33)	10 (3.34)
Connection of ration/rate with multiplication and division	5 (2.59)	17 (8.81)	-	6 (2.01)
Application and understanding of proportionality	4 (2.07)	18 (9.33)	-	7 (2.34)
Make estimates relating to proportions	4 (2.07)	16 (8.29)	-	11 (3.68)
Use theoretical probability and proportion to make predictions	5 (2.59)	22 (11.40)	1 (0.33)	3 (1.00)
Understanding of mathematical operations on rational numbers	4 (2.07)	12 (6.22)	-	2 (0.67)
Use of mathematical expressions and equations	3 (1.55)	11 (5.70)	1 (0.33)	1 (0.33)
Solving linear equations and systems of linear equations	6 (3.12)	25 (12.95)	-	19 (6.35)
Analyzing and representing linear functions	5 (2.59)	26 (13.47)	-	24 (8.03)
Analysis and summarization of data sets	4 (2.07)	14 (7.25)	1 (0.33)	9 (3.01)

Using formulas to determine area and volume	3 (1.55)	18 (9.33)	1 (0.33)	2 (0.67)
Analysis of two and three-dimensional figures using distance and angles	4 (2.07)	19 (9.84)	1 (0.33)	18 (6.02)
Problem-solving	5 (2.59)	8 (4.15)	2 (0.67)	2 (0.67)
Building new mathematical knowledge through problem-solving	3 (1.55)	11 (5.70)	1 (0.33)	2 (0.67)
Strategy use for problem-solving	5 (2.59)	8 (4.15)	-	1 (0.33)
Reflection on the problem-solving process	5 (2.59)	8 (4.15)	-	1 (0.33)
Development and evaluation of mathematical proof	4 (2.07)	39 (20.21)	2 (0.67)	79 (26.42)
Using various methods of mathematical proof	6 (3.12)	44 (22.80)	3 (1.00)	85 (28.43)
Communication of mathematical thinking to others	2 (1.04)	15 (7.77)	1 (0.33)	1 (0.33)
Analyze the mathematical thinking of others	4 (2.07)	15 (7.77)	1 (0.33)	1 (0.33)
Organization and use of mathematical thinking	3 (1.55)	12 (6.22)	2 (0.67)	1 (0.33)
Recognition and use of connections between mathematical ideas	3 (1.55)	11 (5.70)	6 (2.01)	1 (0.33)
Applying mathematics in outside contexts	7 (3.63)	7 (3.63)	3 (1.00)	1 (0.33)
Creating representation to organize, record, and communicated mathematics	3 (1.55)	10 (5.18)	4 (1.34)	1 (0.33)

Table C

Dropped Responses for Implementation of Instructional Practice Recommendations by Teacher Type

Instructional Practice	Unfamiliar	
	Special Education	Mathematics
	n (%)	*n* (%)
Teacher demonstration and modeling	-	1 (0.33)
Guided practice	-	1 (0.33)
Corrective feedback	-	1 (0.33)
Providing time for student verbalization	-	1 (0.33)
Independent practice **	-	1 (0.33)
Providing multiple OTRs	2 (1.04)	20 (6.69)
Use of ongoing formative assessment to guide instruction	1 (0.52)	2 (0.67)
Use of problems with scenarios that may occur in “real world” situations	-	1 (0.33)
Use of problems that are relevant to each student **	2 (1.04)	1 (0.33)
Instruction in word problem structure	2 (1.04)	1 (0.33)
Use of visual representations for modeling	-	1 (0.33)

Directing student to use visual representations	-	1 (0.33)
Use of manipulatives	1 (0.52)	1 (0.33)
Use of graduated instruction or C-S-A	15 (7.77)	38 (12.71)
Technology for instruction	2 (1.04)	2 (0.67)
Technology for practice or review	1 (0.52)	3 (1.00)
Fast fact practice	3 (1.55)	2 (0.67)
Flash cards **	1 (0.52)	3 (1.00)
Foundational skills practice and review	2 (1.04)	3 (1.00)
Peer tutoring	2 (1.04)	1 (0.33)
Cross-age tutoring	8 (4.15)	8 (2.68)
Small group instruction **	-	1 (0.33)
Small group work **	1 (0.52)	1 (0.33)
Use of published curriculum or district adopted curriculum as it is presented	2 (1.04)	5 (1.67)
Individualization of materials	-	1 (0.33)
Adjusting task difficulty	-	1 (0.33)
Selection of ability appropriate lessons and/or curricula	1 (0.52)	2 (0.67)

Providing additional time and opportunities for practice	1 (0.52)	2 (0.67)
Reduction of workload	-	3 (1.00)
Graphic organizers	-	2 (0.67)
Strategy training	5 (2.59)	7 (2.34)
Setting up self-management or self-monitoring programs	3 (1.55)	6 (2.01)
Instruction in self-talk	3 (1.55)	8 (2.68)
Cover copy compare	18 (9.33)	19 (6.35)
Mnemonic devices	3 (1.55)	4 (1.34)
Use of reinforcement for appropriate behavior	-	2 (0.67)
Correction of undesirable behavior	1 (0.52)	2 (0.67)
Maintaining or adjusting classroom management to better suit particular students	1 (0.52)	2 (0.67)
Adjusting classroom routines to encourage and promote appropriate behavior	1 (0.52)	3 (1.00)

** denotes commonly used practice

Table D

Dropped Responses for Impact Ratings of Instructional Practice Recommendations by Teacher Type

Instructional Practice	Teacher Type			
	Special Education		Mathematics	
	Unfamiliar	No opinion	Unfamiliar	No opinion
	n (%)	*n* (%)	*n* (%)	*n* (%)
Teacher demonstration and modeling	-	-	1 (0.33)	1 (0.33)
Guided practice	-	-	1 (0.33)	1 (0.33)
Corrective feedback	-	1 (0.52)	-	1 (0.33)
Providing time for student verbalization	-	2 (1.04)	2 (0.67)	4 (1.34)
Independent practice **	-	-	1 (0.33)	1 (0.33)
Providing multiple OTRs	6 (3.12)	1 (0.52)	15 (5.02)	16 (5.35)
Use of ongoing formative assessment to guide instruction	1 (0.52)	2 (1.04)	3 (1.00)	2 (0.67)
Use of problems with scenarios that may occur in “real world” situations	-	2 (1.04)	2 (0.67)	1 (0.33)
Use of problems that are relevant to each student **	2 (1.04)	6 (3.12)	1 (0.33)	3 (1.00)
Instruction in word problem structure	1 (0.52)	4 (2.07)	2 (0.67)	2 (0.67)
Use of visual representations for modeling	1 (0.52)	3 (1.55)	3 (1.00)	1 (0.33)

Directing student to use visual representations	1 (0.52)	6 (3.12)	3 (1.00)	1 (0.33)
Use of manipulatives	3 (1.55)	5 (2.59)	5 (1.67)	5 (1.67)
Use of graduated instruction or C-S-A	19 (9.84)	21 (10.88)	47 (15.72)	38 (12.71)
Technology for instruction	2 (1.04)	10 (5.18)	7 (2.34)	9 (3.01)
Technology for practice or review	1 (0.52)	10 (5.18)	9 (3.01)	14 (4.68)
Fast fact practice	4 (2.07)	10 (5.18)	6 (2.01)	11 (3.68)
Foundational skills practice and review	3 (1.55)	6 (3.12)	3 (1.00)	4 (1.34)
Peer tutoring	3 (1.55)	14 (7.25)	3 (1.00)	5 (1.67)
Cross-age tutoring	7 (3.63)	33 (17.10)	28 (9.36)	74 (24.75)
Small group instruction **	5 (2.59)	3 (1.55)	7 (2.34)	7 (2.34)
Small group work **	4 (2.07)	4 (2.07)	3 (1.00)	2 (0.67)
Use of published curriculum or district adopted curriculum as it is presented	3 (1.55)	10 (5.18)	5 (1.67)	15 (5.02)
Individualization of materials	4 (2.07)	-	7 (2.34)	10 (3.34)
Adjusting task difficulty	4 (2.07)	2 (1.04)	5 (1.67)	5 (1.67)
Selection of ability appropriate lessons and/or curricula	4 (2.07)	4 (2.07)	5 (1.67)	4 (1.34)
Providing additional time and opportunities for practice	5 (2.59)	-	-	2 (0.67)

Reduction of workload	3 (1.55)	1 (0.52)	1 (0.33)	4 (1.34)
Graphic organizers	3 (1.55)	6 (3.12)	4 (1.34)	10 (3.34)
Strategy training	6 (3.12)	14 (7.25)	4 (1.34)	21 (7.02)
Setting up self-management or self-monitoring programs	4 (2.07)	10 (5.18)	12 (4.01)	31 (10.37)
Instruction in self-talk	7 (3.63)	11 (5.70)	11 (3.68)	50 (16.72)
Cover copy compare	18 (9.33)	33 (17.10)	31 (10.37)	68 (22.74)
Mnemonic devices	3 (1.55)	8 (4.15)	7 (2.34)	15 (5.02)
Use of reinforcement for appropriate behavior	5 (2.59)	2 (1.04)	7 (2.34)	4 (1.34)
Correction of undesirable behavior	3 (1.55)	1 (0.52)	4 (1.34)	3 (1.00)
Maintaining or adjusting classroom management to better suit particular students	4 (2.07)	1 (0.52)	5 (1.67)	4 (1.34)
Adjusting classroom routines to encourage and promote appropriate behavior	5 (2.59)	1 (0.52)	6 (2.01)	3 (1.00)

** denotes commonly used practice

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