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*University of Central Florida*



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COMPARING MIDDLE SCHOOL GENERAL AND SPECIAL EDUCATORS'  
USE OF RESEARCH-BASED INSTRUCTION IN MATHEMATICS FOR  
STUDENTS WITH LEARNING DISABILITIES

by

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M.S. University of Central Florida, 2003  
B.S. University of Central Florida, 2000

A dissertation submitted in partial fulfillment of the requirements  
for the degree of Doctor of Philosophy in Exceptional Education  
in the Department of Child, Family, and Community Sciences  
in the College of Education  
at the University of Central Florida  
Orlando, Florida

Summer Term  
2008

Major Professor: Mary E. Little

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## ABSTRACT

The purpose of this study was to investigate the differences between general and special educators regarding the implementation of research-based strategies that target the needs of students with LD in mathematics, as well as general and special educators' perceptions of their preparedness to use instructional strategies in mathematics. A sample of general and special educators who taught mathematics to students with learning disabilities (LD) at the middle school level responded to an online survey. The survey examined teacher self-reported classroom use of instructional practices specifically aligned with NCTM standards, direct instruction, graduated instruction, grouping practices, and self-monitoring. Additionally, educators responded to perceptions of their preparedness to use the aforementioned instructional practices. From the survey results, several strategies exhibited statistically significant differences between general and special educators. Special educators showed significantly greater use of two instructional strategies, as well as significantly greater perceptions of preparedness to use two instructional strategies. Overall, significantly more special educators reported using the research-based strategies aligned with all instructional practices. Additional results, limitations, implications for practice, and recommendations for future research are provided.

I dedicate this dissertation to the vital people that have supported me throughout this journey, my soulmate Lee Robertson, my mom Virginia Carmell, and my one true gift and the joy of my life, Aidan Riley Robertson.

## ACKNOWLEDGMENTS

Where to begin...

There are so many people that I owe so much to, without whom, those new letters after my name would not be possible...

*I have prayed to the Lord, night-after-night, to give me the strength and focus to get through these three years...and he did.*

--To my soulmate, Lee...without your love and unending support, I surely would never have persevered. Through the journey, known as the doc program, you always stood beside me. You kept telling me that I could do it and listened (and read) so many papers and versions of this dissertation, that you could probably recite it back to me now. For all of the nights that you stayed up with the baby so that I could finish a project or continue my writing, I am so thankful. It has finally come to fruition and I owe so much to you. Now we can be a real family!

--To my mom, Virginia...without you I am not sure where I would be. I have always strived so hard to make and keep you proud of me. You have always told me that I could do whatever I wanted to do, and stood behind me every step of the way. You have been there to help with the baby, as well, and for that I am truly thankful. I would never have finished this program without the two main forces in my life being there for my son while so much of my time has been taken away from you.

--To my son, Aidan...you're going to have your mommy all to yourself now! You are a true gift from God. I owe you so much for your patience with me. From the day you were brought into this world I have been in this program. I feel that we have missed so much time together and we are going to make it up now...I promise! I'm all yours...

--To my dissertation committee, Dr. Mary Little, Dr. Lee Cross, Dr. Enrique Ortiz, and Dr. Rich Mancil. First and foremost, Dr. Little, you have been such a wonderful mentor. Your expertise and guidance throughout this journey has been priceless. I am honored to call you my dissertation chair and friend. I hope to have absorbed one-quarter of your knowledge and professionalism. Next, Dr. Cross, you have been there for me since my undergraduate years. You are such an asset to the program and to all that have the opportunity to work with you. Dr. Ortiz, I first found my interest in mathematics with you. During my undergraduate years, you taught me how to reach students of all diversities and capabilities. Your expertise is so appreciated. And finally, Dr. Mancil, someone who recently went through what I am going through now. Your knowledge and feedback throughout your short time at UCF has been so valued. We will miss you when you leave and look forward to catching up with you at CEC each year. I respect each of you and am so thankful that you have been so supportive the entire way.

--To the rest of the professors that I had the pleasure to collaborate with: Dr. Kevin Miller (Go Sabres), Dr. Wilfred Wienke, Dr. Maria Blanes, Dr. Cynthia Pearl, Dr. Lisa Dieker, Dr. Debbie Hahs-Vaughn, Dr. Eleanor Witta, Dr. Stephen Sivo, Dr. Jennifer Platt, Dr. Martha Lue-Stewart, Dr. Suzanne Martin, Dr. Sherron Roberts, Dr. Rebecca Hines, Dr. Laura Blasi, and Dr. Mike Robinson. Your dedication to the field of education and the preparation of educators is undeniable. I have enjoyed the knowledge that you have shared with me and look forward to collaborating with you in the future.

--A special thank you to Linda Alexander, the most fabulous administrative support anyone could ever hope for. Your smiling face, warm personality, and fabulous sense of

humor were always something to look forward to when entering the suite. If you didn't know the answer, you knew who did...

--To Marcey Kinney, my closest colleague and friend of my cohort. Without you, I surely wouldn't have made it. What a pair we were...staying up to all hours of the night with our little ones. It always helped to have someone who knew what it was like to be a full-time mommy and doc student.

--To the others in my cohort: Heather Batchelder, Kim Davis, David Grant, Chrissy Ogilvie, and Ric Reardon. Your friendship and support from the beginning of our program, when arriving two weeks late after having a baby, has been dear to me. I look forward to our future together as professional colleagues and getting together at conferences, talking about getting through our dissertations...

--And finally, to my Project CENTRAL family: Dr. Little, Anna O'Connor, Rhonda Chubb, Sharonda Elliott, Rocie Tafur, Cindy Huberdeau-Jaeger, Marcy Kinney, Jared Chubb, and Jacelyn DeFrance...what would I do without you? You have been my home-away-from-home. Without your support, I never would have been able to juggle a full-time job into my already hectic life. You truly are so appreciated and have my sincere gratitude. I am so lucky to work with such awesome spirits. I love you all...

If there is anyone that I forgot, please forgive me. You know there's research that shows if your brain gets to a point where it is categorically full, for every new fact that you absorb, you lose a fact that you have stored and no longer use. Wow, I really need to stop that, but I can't!



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## LIST OF ACRONYMS

AYP	Adequate Yearly Progress
CRA	Concrete-Representational-Abstract
DI	Direct Instruction
EAHCA	Education for All Handicapped Children Act
EBD	Emotionally Behaviorally Disturbed
FAPE	Free and Appropriate Public Education
GI	Graduated Instruction
HQ	Highly Qualified
IDEA	Individuals with Disabilities Education Act
IEP	Individualized Educational Plan
IRB	Institutional Review Board
LD	Learning Disabilities
LRE	Least Restrictive Environment
NAEP	National Assessment of Educational Progress
NCES	National Center for Educational Statistics
NCLB	No Child Left Behind
NCTM	National Council of Teachers of Mathematics
NLTS2	National Longitudinal Transition Study-2
NRC	National Research Council
OSEP	Office of Special Education Programs
PCK	Pedagogical Content Knowledge
PL	Public Law
QED	Quality Education Data
RtI	Response to Intervention
SPSS	Statistical Package for the Social Sciences
TIMSS	Third International Math and Science Study
US	United States

## **CHAPTER ONE: INTRODUCTION**

### Introduction

The purpose of this chapter is to provide an introduction to the national concern for mathematics education and instructional practices in mathematics used to meet the needs of students with learning disabilities (LD). An overview presenting the problem, including background and current research will be discussed. The rationale for this investigation will be presented, along with an explanation of the purpose and significance of this research. Finally, the research questions, definitions of terms, assumptions, limitations, and a brief overview of the rest of the study will be explained in detail.

### An Overview of Mathematical Concerns

Educational reform, including revisions of state and national standards, has focused on national concerns regarding the poor mathematics performance of students with and without disabilities in mathematics (Butler, Miller, Crehan, Babbit, and Pierce, 2003). The 2003 National Assessment of Educational Progress (NAEP) described less than one third of fourth-grade students met the proficiency standards in mathematics (Manzo & Galley, 2003). Given these findings, mathematics reform emphasizing the need for visual-based strategies for the planning and delivery of mathematics instruction has been recommended (NCTM, 2000).

The National Council of Teachers of Mathematics (NCTM) has provided standards that call for high-level conceptual understanding and problem solving rather than procedural knowledge and rule-driven computation (Maccini and Gagnon, 2002), an

overview for the Principles and Standards for School Mathematics described the rationale:

“We live in a time of extraordinary and accelerating change. New knowledge, tools, and ways of doing and communicating mathematics continue to emerge and evolve. The need to understand and be able to use mathematics in everyday life and in the workplace has never been greater and will continue to increase. In this changing world, those who understand and can do mathematics will have significantly enhanced opportunities and options for shaping their futures. Mathematical competence opens doors to productive futures. A lack of mathematical competence keeps those doors closed. The National Council of Teachers of Mathematics (NCTM) challenges the notion that mathematics is for only the select few. On the contrary, everyone needs to understand mathematics. All students should have the opportunity and the support necessary to learn significant mathematics with depth and understanding. There is no conflict between equity and excellence.” (NCTM, 2000, p.1)

#### Statement of the Problem

One of the most difficult populations to meet the instructional needs of in mathematics is students with learning disabilities (Hudson, Miller, & Butler, 2006). Documentation shows that “middle school teachers lack the knowledge base necessary to facilitate lessons that require deep levels of subject matter expertise” (Kent, Pligge, & Spence, 2003, p. 43). Reform efforts have proven to be a challenge for teachers when developing effective mathematics instruction for students with learning disabilities (Wang, Coleman, Coley, & Phelps, 2003; Witzel, 2005; Woodward & Montague, 2002). There has been difficulty in creating a curriculum for students, as increased rigor alone underestimates the complexities of teaching to diverse achievement levels. In addition, students with learning disabilities often do not have high levels of academic success (Baxter, Woodward, & Olson, 2001; Baxter, Woodward, Voorhies, & Wong, 2002; Woodward & Baxter, 1997). Visual models and manipulatives have proven to be beneficial to students with learning disabilities (Butler, Miller, Crehan, Babbit, & Pierce,



2003; Cass, Cates, Jackson, & Smith, 2003; Jitendra, Hoff, & Beck, 1999; van Garderen & Montague, 2003; Witzel, Mercer, & Miller, 2003; Woodward, Baxter, & Robinson, 1999). However, for these strategies to be successful, teachers must have the knowledge necessary to teach effectively.

### What Research Suggests

“Teachers themselves need experiences in doing mathematics- in exploring, guessing, testing, estimating, arguing and proving...they should learn mathematics in a manner that encourages active engagement with mathematical ideas” (National Research Council, 1999, p. 65). Professional development can assist teachers in developing these skills, thus developing mathematics instructional strategies for their own classrooms.

Professional development provides educators with deeper Pedagogical Content Knowledge (PCK) and effective research-based instructional strategies (Shulman, 1986). In order for students to develop an understanding of mathematical concepts, the teacher must first comprehend the content to transfer the knowledge; thus teachers’ conceptual understanding of mathematics must first occur.

### Purpose of the Study

The purpose of this study was to investigate the differences between general and special educators regarding the implementation of research-based strategies that target the needs of students with LD in mathematics, as well as general and special educators’ perceptions of their preparedness to use instructional strategies in mathematics. Findings have contributed to research addressing general and special educators’ preparation, knowledge, and use of research-based practices in their middle school classrooms.

### Significance of the Study

There are numerous research-based instructional practices and strategies for teaching mathematics, including several that have been proven effective with students with LD. Mathematical thinking and reasoning skills must be developed so that students may reach conclusions and carry out the processes confidently and successfully (Kelly, 2006; Witzel, 2005). Research-based instructional practices that have been proven effective with students with LD in mathematics include direct instruction (Hasselbring, et.al., 1987; Hudson, Miller, & Butler, 2006, Kelly, Carnine, Gersten, & Grossen, 1986; Kelly, Gersten, & Carnine, 1990; Tarver & Jung, 1995; Woodward, et.al., 1986; Hastings, Raymond, & McLaughlin, 1989; Rivera & Smith, 1988; Wilson & Sindelar, 1991), graduated instruction (Gagnon & Maccini, 2007; Witzel, 2001; Witzel, 2005; Witzel, Mercer, and Miller, 2003) , grouping practices (Allsopp, 1997; Slavin, 1995), and self-monitoring (Clark, Deshler, Schumaker, Alley, & Warner, 1984; Deshler, Warner, Schumaker, & Alley, 1984; Ellis, 1994; Ellis, Deshler, & Schumaker, 1989; Montague, 1992; Montague & Leavell, 1994). The ongoing professional development of general and special educators is vital to increase teacher knowledge of updated instructional practices (Gagnon & Maccini, 2007; Johnson, 2006; Loucks-Horsley, Hewson, Love, & Stiles, 1998; Maccini & Gagnon, 2006). Given the revised standards in mathematics, teacher knowledge, preparation, and implementation of the research-based instructional strategies are critical. This is exacerbated when teaching increasingly complex mathematics content. Therefore, research is needed to illuminate what factors determine the knowledge and implementation of research-based mathematic instruction and strategies developed to reach students with LD for both general and special educators

(Maccini & Gagnon, 2006; Loucks-Horsley, Hewson, Love, & Stiles, 1998, Maccini & Gagnon, 2006). This study posed the following questions:

### Research Questions

1. How do instructional practices in mathematics differ between general and special educators in middle school classrooms?
2. How do general and special educators perceive their preparation to use research-based instructional practices in their middle school classrooms?

This research was conducted through the use of a survey. The survey was adapted, with permission, from one developed by Paula Maccini, Ph.D. and Joseph Gagnon, Ph.D. The research described differences in teachers' perceptions of mathematics preparation between general and special educators as well as differences in their pedagogical content knowledge. These will be discussed in Chapter 3.

### Assumptions

It was assumed that:

- Teachers' self reports of instructional practices were accurate, meaning that teachers implement the instructional practices in their classrooms how they are intended to be implemented.
- Teachers had appropriate access to the internet to take the online survey, meaning that a computer was available for them to access the online survey either at school or home.
- Accuracy, validity, and reliability of the original survey, meaning that the reported technical adequacy was within acceptable limits.

## Limitations

Limitations to the study may have been:

- Respondents with older computers may have experienced a lack of compatibility with the survey, such as loading time, a difference in operating system which changes the visual depiction, and the use of computer logic.
- Return/response rate due to challenges of online survey research which will be discussed further in Chapter 5.

## Definition of Terms

Abstract Level- A teaching method that uses written words (including Braille), symbols (such as variables or numerals), verbal expressions, or sign language (NCTM, 2000).

Adequate Yearly Progress (AYP)- An individual state's measure of progress toward the goal of 100 percent of students achieving to state academic standards in at least reading/language arts and math (NCLB, 2001).

Chi-square-The chi-square test is used to test if a sample of data came from a population with a specific distribution (Vogt, 2007).

Collaboration- A structured, recursive process where two or more people work together toward a common goal (Slavin, 1996).

Concrete Level- A teaching method that uses actual objects such as people, shoes, toys, fruits, cubes, base-ten blocks, or fraction tiles to learn concepts and skills (NCTM, 2000).

Cooperative learning- The instructional use of small groups so that students work together to maximize their own and each other's learning (Johnson & Johnson, 1994)

CRA- Concrete-to-Representational-to-Abstract (see individual definitions).

Direct Instruction- It is the explicit teaching of a skill-set using lectures or demonstrations of the material (Hasselbring, et.al., 1997).

Disabilities- A physical or mental handicap, especially one that prevents a person from living a full, normal life or from holding a gainful job (NCLB, 2001).

Education for All Handicapped Children Act (EAHCA)- Initial legislation enacting specific rights for students with disabilities in public educational institutions (EAHCA, 1975).

Free and Appropriate Public Education (FAPE)- Schools must provide students with an education, including specialized instruction and related services, that prepares the child for further education, employment, and independent living (IDEA, 1997).

Graduated Instruction- A non-linear approach, utilizing the idea of 'levels of learning' to instruct students at the concrete level, representational level, and the abstract level (Gagnon & Maccini, 2007).

Grouping Practices- Grouping students either in small groups or pairs to work collaboratively (Johnson & Johnson, 1994).

Highly Qualified- Under the *No Child Left Behind Act*, all teachers of core academic subjects must hold at least a bachelor's degree, have full state certification, and demonstrate knowledge in the core academic subjects they teach (NCLB, 2001).

Inclusive setting- Teachers working with students in a context that is suitable to a diverse population of students (NCLB, 2001).

Individualized Education Plan (IEP)- Provision in IDEA that requires students with disabilities to receive an educational program based on multi-disciplinary

assessment and designed to meet their individual needs. The law requires that a program be developed and implemented that takes into account the student's present level of performance; annual goals; short-term instructional objectives; related services, percent of time in general education; time line for special education services; and an annual evaluation (IDEA, 1997).

Individuals with Disabilities Education Act (IDEA)- Legislation requiring students with disabilities to have access to the general curriculum (IDEA, 1997).

Instructional practices- Practices typically thought to improve student academic performance (IDEA, 1997).

Learning Disabilities (LD)- According to government regulations, students with learning disabilities have disorders in one or more basic psychological processes involved in understanding or using language, spoken or written, which may manifest itself in an imperfect ability to listen, think, speak, read, write, spell or do mathematical calculations (NCLB, 2001).

Least Restrictive Environment (LRE)- Provision in the law (IDEA) that requires students with disabilities to be educated to the maximum extent appropriate with their non-disabled peers (IDEA, 1997).

Legislation- A proposed or enacted law or group of laws.

Manipulatives- Any of various objects designed to be moved or arranged by hand as a means of developing motor skills or understanding abstractions, especially in mathematics (NCTM, 2000).

Mathematical fluency- The ability to fluently recall the answers to basic math facts (NCTM, 2000).

No Child Left Behind (NCLB)- Legislation requiring teachers to be highly qualified and requiring schools to be held accountable for the assessment of all students (NCLB, 2001).

Pedagogical Content Knowledge (PCK)- A subset of the content knowledge that has particular utility to planning and conducting lessons that facilitate learning (Shulman, 1986).

Pedagogy- the activities of educating or instructing; activities that impart knowledge or skill (IDEA, 2004).

Professional development- Training to keep current with changing technology and practices or content in teaching (NCLB, 2001).

Representational Level- A teaching method that uses pictures, tally marks, diagrams, and drawings. These pictorial representations relate directly to the manipulatives and set up the student to solve numeric problems without pictures (NCTM, 2000).

Sampling Error- Sampling error is the error caused by observing a sample instead of the entire population (Dillman, 2007).

Scientifically-based Instruction- The emphasis on scientifically-based instruction supports the consistent use of instructional methods that have been proven effective (NCLB, 2001).

Self-monitoring- Monitoring one's own behavior to elicit a wanted performance or skill (Montague, 2003).

Self-regulation- Self-regulated learners believe that opportunities to take on challenging tasks, practice their learning, develop a deep understanding of subject matter,

and exert effort will give rise to academic success (Perry et al., 2006).

Spam- Junk mail that recipients receive in their emails accounts.

Systematic Replication Study- A study that varies from the original study only in some minor aspect, such as more standardized procedures, different setting, or less levels of the independent variable than the original study (Vogt, 2007).

Technical adequacy- The technical adequacy of research is comprised of the validity, reliability, and freedom of bias of the study.

Triangulation- The attempt to increase reliability by reducing systematic (method) error, through a strategy in which the researcher employs multiple methods of measurement (ex., survey, observation, archival data) (Vogt, 2007).

#### Organization of the Study

Chapter one will introduce the research problem and explain the purpose of the study. Chapter two will review the relevant literature as a basis to the identified problem. Chapter three will describe the methodology of the quantitative study. The analyzed results of the research will be provided in Chapter Four. Finally, chapter five will summarize the findings of the research, describing limitations of the current research and make recommendations for further research.



## CHAPTER TWO: LITERATURE REVIEW

### Introduction

The purpose of this chapter is to provide a comprehensive literature review examining mathematics instruction for students with learning disabilities. First, an introduction of educational concerns in mathematics is provided. Next, an overview of pertinent legislation framing education for students with disabilities is reviewed. Then, educational reform and current research related to pedagogical content knowledge in mathematics will be discussed.

### Overview of Mathematics

National concern for quality education has increased due to international comparisons of student achievement showing a lag in U.S. students' math scores compared to other industrialized nations (Aronson, Zimmerman, & Carlos, 1998; Bottge, Rueda, Serlin, Hung, & Kwon, 2007; Maccini & Gagnon, 2002). Students in the United States are not performing as well in math as students in other developed countries (Lemke, Sen, Partelow, Miller, Williams, et.al., 2004; Mullis, Martin, Gonzalez, & Chrostowski, 2004; National Center for Educational Statistics, 2003; Schmidt, 2002). The Third International Math and Science Study (TIMSS) scores showed U.S. eighth grade students were outperformed by nine other countries' students (Gonzalez, Guzman, Partelow, Pahkle, Jocelyn, Kastberg, & Williams, 2004). Based on data from TIMSS, research from the National Institute on Educational Governance, Finance, Policymaking, and Management (1998) showed that U.S. student performance was lacking in advanced mathematics and problem solving (Maccini & Gagnon, 2002). Additionally, on the

National Assessment of Educational Progress, only one-fourth of the eighth grade and twelfth grade U.S. students scored at the proficient level in mathematics (Braswell, Lutkus, Grigg, Santapau, Tay-Lim, & Johnson, 2001; National Assessment of Educational Programming, 2002). The disparities of U.S. math scores have been attributed to differences in instruction (Bottge, Rueda, Serlin, Hung, & Kwon, 2007). Teachers in countries that exhibit the highest achievement scores in mathematics have developed a deeper understanding of subject matter (Ma, 1999). Teachers are more likely to provide clearer explanations, make more efficient use of their class time, and engage students in inquiry by using whole-class pedagogical techniques (Linn, Lewis, Tsuchida, Songer, 2000; Perry, 2000; Stevenson & Lee, 1995; Stigler & Hiebert, 1999).

Mathematics instruction in the U.S. suffers from a splintered vision, focusing on too many superficially taught topics in a school year (Schmidt, McKnight, and Raizen, 1997). “Traditional mathematics curricula have been criticized for being relatively repetitive, unfocused, and undemanding” (Hiebert, 1999, p. 11). The National Council of Teachers of Mathematics (NCTM, 2000) has addressed these concerns regarding a more focused set of standards along with the professional development of teachers in the content areas. NCTM standards emphasize the development of mathematical thinking, which is accomplished through students’ active engagement (Gagnon & Maccini, 2007). NCTM (2000) standards also focus on higher-level thinking, reasoning, and problem solving skills relating to the real world.

It is difficult for teachers to facilitate learning in mathematical processes such as problem-solving and using multiple representations without strong conceptual understanding themselves (Rousseau-Anderson & Hoffmeister, 2007). Many U.S.

teachers lack the necessary conceptual understanding to teach mathematic reasoning skills (Ball, 2003; Ma, 1999). “Products of traditional mathematics education, these teachers doubt their own ability to think mathematically, and view mathematics as a mystifying sequence of facts, definitions, and rule-governed procedures” (Schifter & Fosnot, 1993, p. 63). Therefore, although educators are expected to base instruction on validated approaches (NCLB, 2001), instructional decisions are often based on personal situations and perceptions (Manouchehri, & Goodman, 1998).

In addition, due to the various difficulties students have with grasping mathematical concepts, teachers face great challenges in providing instruction to meet the instructional needs of students with learning disabilities. The inclusion of students with learning disabilities into the mathematics classroom continues to be the greatest challenge for teachers in the United States (Baxter, Woodward, Voorhies, and Wong, 2002).

It is estimated that five to eight percent of students (K-12) have learning disabilities in mathematics (Badian, 1983; Geary, 2004). The amount of students with disabilities in the general education classroom has increased over the past decade to nearly fifty percent (National Center for Educational Statistics, 2005). Therefore, general educators must be familiarized with techniques to reach students with LD. One way to meet the diverse ability levels of learners is through teacher preparation in research-based instructional strategies in mathematics.

Students with learning disabilities (LD) may have difficulties with higher-level problem-solving tasks (Hutchison, 1993; Maccini, McNaughton, & Ruhl, 1999). This can present a challenge for teachers. A large-scale longitudinal study of more than 2,000 middle school students showed that the middle school environment often emphasizes rote

memorization, basic skills, competition, and less creative assignments than elementary school (Eccles & Midgley, 1989). The contextual changes in environment have directly contributed to student performance (Midgley, Feldlaufer, & Eccles, 1989). Research has demonstrated that factors such as cognitive ability, cognitive style, and inadequate curricular materials, may contribute to the gaps between middle school students with and without learning disabilities (Zentall & Ferkis, 1993). There is a need for effective interventions for students with learning disabilities. Results from an intervention study using QuickSmart with middle school students indicated that although mathematics scores of students with LD were below their peers, there was a significant improvement from pretest to posttest (Graham, Bellert, Thomas, & Pegg, 2007).

Another study described how the addition of peer-assisted learning strategies (PALS) in mathematics influenced students in a middle school mathematics classroom. After training 150 seventh graders in PALS, and using those strategies consistently for several months, the teacher saw increases in student achievement. She had her students do a short writing exercise to find out students' feelings about PALS. Examples of student responses were, 'I like PALS because when I take a test, I can say the script in my head', 'I really like PALS because I can relate to my partner and help that person in any way I can, and I also like the scripts', and 'What I dislike about math PALS is you have to hear the script over and over again, which kind of gets annoying.' Although responses were both positive and negative regarding the scripted intervention, results showed increased engagement and achievement in a content area notoriously challenging for middle school students with identified learning disabilities in mathematics.

In a Maryland study, Maccini and Gagnon (2002) identified three factors affecting teachers' decisions regarding math instruction: 1) teacher knowledge of and familiarity with the content, 2) teacher preparation, and 3) teacher beliefs and orientation. A significant difference in perceptions of preparedness to teach mathematics between general and special educators was found as special educators' felt less prepared than that of their general educator counterparts.

Teachers must be knowledgeable of instructional strategies to assist students with learning disabilities. Maccini & Gagnon (2000) found that recommended instructional strategies included: a) instructional strategies consistent with the NCTM standards, b) direct instruction, c) graduated instruction, d) grouping practices, and e) self-monitoring. Additionally, their research showed that nearly half of the special educators did not have knowledge of the NCTM standards. The respondents reported instruction mostly in basic math to students with LD instead of higher-level math such as algebra.

Teacher preparation includes preservice education as well as ongoing professional development, and can affect the use of instructional strategies (Culatta, Tompkins, & Werts, 2003). "Teachers who possess a deep and broad understanding of fundamental math provide more rigorous instruction for their students, which in turn leads to higher student achievement in math" (Swanson, 2000, p.3). Given the revised standards in mathematics, teacher knowledge, preparation, and implementation of the research-based instructional strategies are critical. This is amplified when teaching higher order mathematics content.

Therefore, research is needed to expound what factors determine the knowledge and implementation of research-based mathematic instruction and strategies developed to

reach students with LD for both general and special educators (Maccini & Gagnon, 2006; Loucks-Horsley, Hewson, Love, & Stiles, 1998, Maccini & Gagnon, 2006). The importance and necessity of teacher preparation, as well as the need for research-based instructional practices and pedagogical content knowledge is noted in the most recent legislation, IDEA (2004), and supported by research (Gagnon & Maccini, 2007).

### Legislation

Current legislation targets achievement and accountability for students with learning disabilities. The education of students with learning disabilities has historically met with controversial issues which have shaped legislation over time. Over three decades of mandates have shaped public education to what it is currently, beginning with the Education for All Handicapped Children Act (EAHCA, 1975). The next two mandates that have impacted instruction for students with disabilities are the Individuals with Disabilities Act (IDEA) and the No Child Left Behind Act (NCLB). IDEA mandates that students with learning disabilities be provided access to the general curriculum and given meaningful opportunities to acquire skills and knowledge. Additionally, instruction must be provided in ways that effectively address their need for academic progress. A timeline of the key components of these mandates related to access to the general education curriculum follows in Table 1 (Essex, 2006).

*Table 1. Comparison of Mandates*

Year	Description of Mandate
1975	<p data-bbox="428 338 1321 375">Education for All Handicapped Children Act (EAHCA) (P.L. 94-142)</p> <ul style="list-style-type: none"> <li data-bbox="380 417 1312 527">• Requires states to provide a free and appropriate public education for children with disabilities (ages 5 to 18)</li> <li data-bbox="380 564 1068 602">• Requires individualized education programs (IEP)</li> <li data-bbox="380 640 1052 678">• First defined least restrictive environment (LRE)</li> </ul>
1997	<p data-bbox="428 711 1268 749">Individuals with Disabilities Education Act (IDEA) (P.L. 105-17)</p> <ul style="list-style-type: none"> <li data-bbox="380 787 1364 896">• Requires schools to assume greater responsibility for ensuring that students with disabilities have access to the general education curriculum</li> <li data-bbox="380 934 1385 1043">• Allows special education staff who are working in the mainstream to assist general education students when needed</li> <li data-bbox="380 1081 1312 1119">• Requires a general education teacher to be a member of the IEP team</li> <li data-bbox="380 1157 1349 1266">• Requires students with disabilities to take part in state-wide and district-wide assessments</li> </ul>
2001	<p data-bbox="428 1304 821 1341">No Child Left Behind (NCLB)</p> <ul style="list-style-type: none"> <li data-bbox="380 1379 1365 1564">• Requires states to develop plans with annual measurable objectives that will ensure that all teachers teaching in core academic subjects are highly qualified.</li> <li data-bbox="380 1602 1344 1787">• Requires local school districts to ensure that all Title I teachers in core academic subjects hired after the first day of the 2002-2003 school year are highly qualified</li> </ul>

## Individuals with Disabilities Education Act

Twenty-two years after the Education for All Handicapped Children Act (EAHCA, 1975), the Individuals with Disabilities Education Act (IDEA) 1997 was enacted. IDEA mandated free and appropriate public education (FAPE), the Individualized Education Plan (IEP), and the Least Restrictive Environment (LRE) to assure greater access to the general curriculum. Legislation leading up to this point had served as the framework for LRE for students with disabilities. IDEA has provided the rationale for the inclusive setting, providing access to the general education curriculum to students with LD. A vital component of this mandate is access to the general curriculum. Forty-nine percent of students with LD are in a general education classroom 80 percent of the school day (U.S. Department of Education, 2007).

IDEA requirements call for Individual Education Plans (IEPs) to plainly identify how the student is involved in the general education curriculum as well as progress made (Soukup, Wehmeyer, Bashinski, & Bovaird, 2007). There are, however, no specific mandates regarding what is taught and the delivery of instruction. Inclusive practices should be focused on supports, content and delivery of instruction, not where students have access to the general curriculum (Soukup, Wehmeyer, Bashinski, & Bovaird, 2007). Diverse learning and instructional needs of students with LD (McLeskey, Henry, & Axelrod, 1999; Morocco, 2001) partnered with the mandates for increased and improved access to the general education curriculum produces a great challenge for educators. Accountability for instructional progress was strengthened with the passing of the No Child Left Behind Act.



## No Child Left Behind Act

The No Child Left Behind Act of 2001 (NCLB) was enacted to reform and improve achievement and outcomes of all students, regardless of disability. NCLB, the reauthorized version of the Elementary and Secondary Education Act (ESEA), is arguably the most significant piece of federal education legislation in history (Yell, Katsiyannas, & Shiner, 2006), enveloping local, state, and federal efforts to ensure achievement gains for all students. The major principles of NCLB (2001) are:

1. Stronger accountability for results
2. Increased flexibility and local control
3. Expanded options for parents
4. An emphasis on scientifically-based teaching methods that have been proven to work

“NCLB requires all states to establish state academic standards and a testing system that meets federal requirements” (Essex, 2006, p.1). The liability for schools and districts to perform academically is reported through adequate yearly progress (AYP) measurements. Schools often do not attain adequate yearly progress due to the federal expectations to achieve proficiency levels by the 2013-2014 school year of all students, including the 6.6 million students in special education (Simpson, LaCava, & Graner, 2004). This expectation puts pressure on teachers to meet these goals (Thornton, Peltier, & Medina, 2007).

To address the increased accountability for learning, the preparation, knowledge, and skills of teachers was also a focus of NCLB. NCLB has mandated that teachers must meet specific state standards in the area that they teach, identifying them as highly

qualified (U.S. Department of Education, 2003). NCLB's criteria of highly qualified is an educator who has a bachelor's degree, is fully certified, and can prove they have content-knowledge in the area that they teach. NCLB addresses subject knowledge (Chamberlin, Plucker, and Kearns, 2003) as:

- All new elementary school teachers must pass a state test of general subject knowledge and teaching skills.
- New middle school and secondary school teachers must have either studied their subject as an undergraduate or graduate major (or have advanced certification), or must pass a state subject test.

Existing teachers must have either met the applicable subject knowledge criteria for new teachers, or must demonstrate competence in all subjects taught based on a state standard of evaluation. Under NCLB criteria, current special educators, regardless of past instructional success, will no longer be considered highly qualified (King-Sears, 2005), and will have four years to meet the same standards (Rose, 2002), thereby increasing the accountability of educators. Increased accountability requirements were further supported by the most recent reauthorization, the Individuals with Disabilities Education Act (Revised) 2004, which attempts to further align the requirements for general and special education.

#### Individuals with Disabilities Education Act (Revised) 2004

The latest mandate to be revised is IDEA (R) 2004. The revised act added language requiring the implementation of scientifically-based teaching methods as aligned with NCLB and ongoing professional development. Additionally, a goal of IDEA 2004 was to ultimately align NCLB and IDEA (Paige, 2001). IDEA 2004

emphasizes access for students with disabilities to the general curriculum more than any previous mandate (Abell, Bauder, & Simmons, 2005). This access calls for increased collaborative efforts between general and special educators more than ever. NCLB and IDEA differ, however, in that NCLB emphasizes group data and may be construed as being misaligned overall (Yell, Katsiyannas, & Shiner, 2006) with IDEA. A comparison of NCLB and IDEA relates that IDEA is more focused on the individual student (See Table 2) (Yell, Katsiyannas, & Shiner, 2006).

*Table 2. Comparison of NCLB and IDEA: Standards and Assessment Accountability*

<b>Provision/Concept</b>	<b>NCLB</b>	<b>IDEA</b>
Instructional priority	Academics (reading/mathematics)	Academics and social/behavioral, transition-related
Focus of assessment system	Endpoint, single, primary measure, sanctions	Entry point: Present levels of academic and functional performance multiple measures, services
Accountability focus	Group-school centered (AYP)	Individual-person-centered (IEP)
Valued metric	Proficiency level	Progress
Goal focus	Absolute and uniform	Relative and modified
Priority of accommodation strategy	Preserved measurement constructs	Increased inclusion in assessment
Universal design principles	Consider content, format, language demands	Consider content, format, language, and social/behavioral demands

Though differences exist in the current mandates at the end, the focus to provide students with learning disabilities access to the general curriculum is the same.

In 2001, The Office of Special Education Programs (OSEP) conducted national research to determine access to the general curriculum. ‘Greater participation and success in the general curriculum’ was identified as the top response regarding improving the lives of children with disabilities. The report also concurred with the prior literature base, indicating that general education and special education have differing agendas, which ultimately impede collaboration (Bauwens & Hourcade, 1997; Gersten, Darch, Davis, & George, 1991; Hargreaves, 1994; Voltz, Elliot, & Harris, 1995; Wade, Welch, & Jensen, 1994; Walter-Thomas, 1997; West & Idol, 1990).

The National Longitudinal Transition Study-2 (NLTS2) described a direct relationship between the amount of courses students with learning disabilities take in the general curriculum and their social adjustment at school (Blackorby, Chorost, Garza, & Guzman, 2003; Marder, Wagner, & Sumi, 2003). Access to the general curriculum calls for more than being in the general education classroom though, it requires “educational programs based on high expectations that acknowledge each student’s potential and ultimate contribution to society” and that “students with disabilities be provided with the supports necessary to allow them to benefit from instruction” (Nolet & McLaughlin, 2000, pp. 2, 9).

### Potential Impact

Legislation and mandates affect students with learning disabilities regardless of instructional placement. Specifically, NCLB necessitates teachers’ documentation in each school of student improvement, showing proficiency in math by the end of the

2013-2014 school year (Yell, Katsiyannas, & Shiner, 2006). Thus, educators must be familiar with the most current legislation regarding students with learning disabilities, as well as the most current research-based strategies and available resources to ensure students are being served in the least restrictive environment. Collaborative efforts must occur and can greatly impact the success of inclusive practices. Collaboration requires sufficient time, training, and resources to be successful (Mastropieri & Scruggs, 2007). The goal of all of the new mandates is to break down the barriers between general education and special education, promoting collaborative efforts and the success of students with learning disabilities in the least restrictive environment by highly qualified teachers.

Currently, eleven states reported that at least 95% of their teachers were highly qualified. However, 30 of the 39 responding states reported that highly qualified teachers were in more than half of the classrooms (Feller, 2003). Department of Education (DOE) statistics (2003) however, countered the report showing that nearly half of all secondary teachers did not have majors in their content area, and 25% did not even have a minor (Tracy & Walsh, 2004). Clearly, there is a need for highly qualified and knowledgeable teachers in mathematics for students with learning disabilities.

#### Reform in Mathematics

Within the legislative framework to improve accountability for student learning, standards-based reform is underway (Aronson, Zimmerman, & Carlos, 1998). Student-centered instruction is a focus of current reform in mathematics where “students are ultimately responsible for their own learning” (Hudson, Miller, & Butler, 2006, p. 22). Major elements of standards-based reform are: a) higher content standards, b) the use of

assessments aimed at measuring how schools are helping students meet the standards, and c) an emphasis on holding educators and students accountable for student achievement (Nolet & McLaughlin, 2000).

“Successful reform requires acceptance and adoption by teachers” (McCaffrey, Hamilton, Stecher, Klein, Bugliari, & Robyn, 2001, p. 493). The mathematics reform movement has been in motion for well over a decade (Montague, 2003). A leading advocate of reform-based mathematics is the National Council of Teachers of Mathematics (NCTM).

#### The National Council of Teachers of Mathematics

National standards have been recently established through the leadership of professional organization, especially the National Council of Teachers of Mathematics (NCTM). NCTM (2000) standards call for mathematical thinking through active engagement (Gagnon & Maccini, 2007) and are the foundation of mathematical reform. National standards developed by NCTM summarize what all students should know by the completion of their public education (Nolet & McLaughlin, 2000). NCTM’s (2000) focus includes higher-level thinking, reasoning, and problem-solving skills relating to the real-world, addressing conceptual understanding.

The National Council of Teachers of Mathematics (NCTM) and state standards call for students to explore math through hands-on means in order to help build math problem-solving and higher order thinking (Witzel, 2005). Instructional practices must facilitate students building knowledge through problem solving, solving problems that arise in mathematics and in other contexts, applying and adapting a variety of appropriate

strategies to solve problems, and monitoring and reflecting on the process of mathematical problem solving. “Students should have frequent opportunities to formulate, grapple with, and solve complex problems that require a significant amount of effort and should then be encouraged to reflect on their thinking; problem solving is an integral part of all mathematics learning, and so it should not be an isolated part of the mathematics program” (NCTM, 2000, p. 52). A central theme of *Principles & Standards for School Mathematics* (NCTM, 2000) is mathematical problem solving, advocating that teachers act as facilitators assisting students to construct their own understanding. However, given the specific characteristics of students with learning disabilities, considerations to instruction in mathematics must be addressed.

“Students with LD are characteristically poor mathematical problem solvers and, as such, most likely will have difficulty in a constructivist context that emphasizes individual construction of knowledge, conceptual understanding, and articulation of ideas and reasoning. However, with supplemental, intensive, and explicit instruction, students with LD may be able to participate more fully in inclusive mathematics classrooms. Additionally, it is essential that teachers have an understanding of the semantic and mathematical demands of the problems, the cognitive and metacognitive processes and strategies that facilitate problem solving, and the instructional principles that foster learning” (Montague, 2003, p.167).

Mathematics difficulties emerge in primary grades and continue as students progress through secondary grades (Baroody and Hume, 1991; Engelmann, Carnine, and Steeley, 1991; McLeod and Armstrong, 1982; Mercer and Miller, 1992). Students with learning disabilities typically perform academically about two grade levels behind their peers without disabilities (Wagner, 1995). Specifically, students with disabilities fail to achieve a sufficient conceptual understanding of the core concepts that underlie

operations and algorithms used to solve problems that involve whole and rational numbers (Baroody and Hume, 1991; Hiebert and Behr, 1988).

Research shows that students who exhibit difficulties in math suffer from slow retrieval of basic facts and operations (Hasselbring, Bransford, and Goin, 1988).

Impulsivity is another problem found in the research of math difficulties. Geary (2005) and Passolunghi and Siegel (2004) offer an example of a student answering 5 or 9 when asked what  $4 + 8$  is. They explain that because these are the next numbers, a student who answers impulsively may answer as such. Further research has shown three potential characteristics of students that exhibit difficulties in math:

1. problems forming mental representations of math concepts (Montague & Applegate, 2001; Geary, 2004)
2. weak ability to access numerical meaning from symbols (Gersten & Chard, 1999; Rousselle & Noel, 2006)
3. problems keeping information in working memory (Passolunghi & Siegel, 2004; Swanson & Beebe-Frankenberger, 2004)

“Developing higher level thinking skills and fluency and flexibility with numbers in young students supports the idea for implementing manipulative-based problem solving in the classroom (Kelly, 2006, p.185). The lack of academic success may be the result of mismatched instructional material and student skill (Daly, Martens, Kilmer, & Massie, 1996; Daly, Witt, Martens, & Dool, 1997; Enggren & Kovaleski, 1996; Gravois & Gickling, 2002).



## Mathematics Instruction

Research-based methods in mathematics instruction, as well as teacher knowledge and implementation of these methods, must be investigated to assure content mastery in alignment with revised math content standards and state funded accountability mandates. NCTM advocates appropriate, challenging instructional materials leading to improved mathematics achievement (Burns, 2002; Gickling, Shane, & Croskery, 1989). In addition, several recent trends have exacerbated the designing of effective instructional practices for students with LD (Swanson & Deshler, 2003). Considerations include a) the expectation that all learners, including those with LD, meet curriculum standards adopted by states and professional organizations (Erickson, Ysseldyke, Thurlow, & Elliot, 1998); b) the prevailing practice of including students with LD in the general education classroom for the vast majority of the school day (Hock, Schumaker, & Deshler, 1999; c) the explosion of knowledge and information and the growing expectation that all students not merely acquire but integrate thinking skills within subject area in authentic problem-solving activities (Kame'enui & Carnine, 1998); and d) the clear expectation set forth in the Individuals with Disabilities Education Act (IDEA) Amendments of 1997 that programming for students with disabilities be outcome based within the context of successfully mastering—and not merely gaining access to—the general education curriculum (Turnbull, Rainbolt, & Buchele-Ash, 1997). Although no single instructional practice can be recommended (Swanson & Deshler, 2003), several research-based instructional methods in mathematics that have been validated as effective for students with LD are direct instruction, graduated instruction, grouping practices, and self-monitoring.

## Direct Instruction

Direct instruction has been consistently identified as an effective teaching method for students with LD (Hasselbring, et.al., 1987; Hudson, Miller, & Butler, 2006, Kelly, Carnine, Gersten, & Grossen, 1986; Kelly, Gersten, & Carnine, 1990; Tarver & Jung, 1995; Woodward, et.al., 1986; Hastings, Raymond, & McLaughlin, 1989; Rivera & Smith, 1988; Wilson & Sindelar, 1991). Direct instruction is designed to facilitate student learning through “a) organizing central concepts and strategies in ways that allow application across multiple contexts; b) providing clear and systematic methods of teacher communication, decreasing the likelihood of student misunderstanding or confusion; c) the use of formats involving structured verbal exchanges between students and teachers, allowing for increased student engagement, ongoing progress monitoring, and repeated verbal practice; d) strategically integrating skills to ensure efficient learning and understanding; and e) arranging instructional concepts into tracks in which learning develops across the length of the program while providing ongoing review and generalization” (Flores & Kaylor, 2007, p. 84).

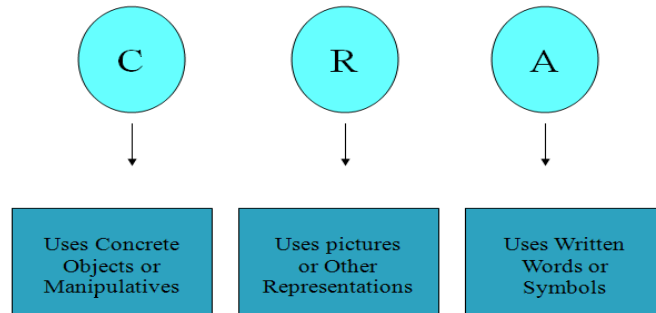
Several studies have shown increased mathematics achievement with direct instruction. A study of 30 seventh-grade students, identified as at-risk for mathematic failure, investigated the effects of direct instruction which demonstrated significant improvement in math skills. The goal of another study was to show that adapting direct instruction by including a graphic organizer improved performance particularly increasing understanding of concepts that justified the procedures for solving systems of linear equations (Ives & Hoy, 2003). Anecdotal evidence from the study supported the hypothesis that the graphic organizer was helpful for this high-level mathematics skill. Direct instruction has proven to be a powerful instructional model (Hasselbring, et al., 1987; Kelly, Carnine, Gersten, & Grossen, 1986; Kelly, Gersten, & Carnine,

1990; Tarver & Jung, 1995; Woodward, et al., 1986; Hastings, Raymond, & McLaughlin, 1989; Rivera & Smith, 1988; Wilson & Sindelar, 1999). Three additional instructional practices (graduated instruction, grouping practices, and self-monitoring) have been researched to determine their impact on students with learning disabilities.

### Graduated Instruction

Graduated instruction is a three-phase approach which includes a concrete phase, a semi-concrete phase, and an abstract phase (Gagnon & Maccini, 2007). Also referred to as the Concrete-to-Representational-to-Abstract (CRA) instructional approach, graduated instruction is one way to approach levels of learning for students with learning disabilities. All levels of learning are interchangeable, meaning that flexibility may occur during learning, using all levels at different times. Research has shown that the use of mathematics tools—a form of representation—can help make abstract concepts concrete and understandable so that children can solve problems that would be out of reach otherwise (National Research Council, 2001). CRA is a three-stage non-linear learning process where students learn through physical manipulation of concrete objects, learning through pictorial representations of the concrete manipulations, and solving problems using abstract notation (Witzel, 2001; Witzel, 2005; Witzel, Mercer, and Miller, 2003).

Students' understanding of abstract concepts transform such complex concepts into concrete manipulations and pictorial representations (See Figure 1) (Devlin, 2000; Witzel, Mercer, and Miller, 2003).



*Figure 1. Learning Levels-CRA*

Although student achievement has been linked to teachers' experience with manipulatives (Raphael & Wahlstrom, 1989; Sowell, 1989), little is known about how manipulatives are used in instruction. Research on the use of manipulatives has shown that students who use them outperform students that do not (Driscoll, 1983; Greabell, 1978; Raphael & Wahlstrom, 1989; Sowell, 1989; Suydam, 1985, 1986; Witzel, 2001). The CRA sequence of instruction has been beneficial to students with disabilities and academic difficulty in the learning of basic facts (Harris, Miller, & Mercer, 1995; Mercer & Miller, 1992) initial fractions (Jordan, Miller, & Mercer, 1999), and higher level math (Huntington, 1994; Maccini & Hughes, 2000; Maccini & Ruhl, 2000).

Not only do the statistical analyses support CRA instruction for middle-school students who need remediation in math, they also support the use of CRA techniques for students with a history of high math achievement (Witzel, 2005).

Although much research on CRA has focused on the effectiveness with arithmetic instruction (Miller & Mercer, 1993), recently more researchers have attempted to design CRA models for algebra instruction (Borensen, 1997; Maccini & Hughes, 2000; Witzel, 2001).

A study comparing students in the United States and students in China investigated the relationship between early algebra learning and teachers' beliefs, specifically on how students selected solution strategies (Cai, 2004). The study looked at the use of visual representations with fourth and fifth grade students. The reported findings confirmed that U.S. students used representational strategies far less than Chinese students. Another study researching the use of the CRA sequence of instruction to solve linear algebraic functions across procedural approaches provided insight into inclusive settings. The findings support the use of CRA instruction for students needing remediation in mathematics.

With a primary goal being mathematical fluency (NCTM, 2000), teachers are encouraged to identify ways that students' learning occurs. "Development of higher level thinking skills and fluency and flexibility with numbers in young students supports the idea for implementing manipulative-based problem solving in the classroom" (Kelly, 2006, p. 185). The apparent success of the CRA approach shows promise for inclusive settings where students are highly varied in their math abilities.

Initial research for the use of manipulative devices within graduated instruction shows improved student learning. However, there appears to be rather low usage rates among teachers (Butler, Miller, Crehan, Babbit, and Pierce, 2003). Continued research is needed regarding the knowledge and use of graduated instruction for students with learning disabilities to meet math content standards. Another instructional strategy that has been validated with students with learning disabilities is the use of various grouping practices (Gagnon & Maccini, 2007).

## Grouping Practices

Grouping practices, such as cooperative learning activities (Hutchinson, 2007; Ramsden, 2003) and class-wide peer tutoring (DuPaul, Ervin, Hook, & McGoey, 1998; Greenwood, Delquadri, & Carta, 1997; King-Sears & Bradley, 1995) have been determined to be effective for teaching algebra problem-solving skills (Swanson & Deshler, 2003). Essential components of cooperative learning include adaptations to individual needs (Chiu, 2004; Siegel, 2005; Slavin, 1995). Students are often more aware than teachers are of what their peers do not understand (Brinckerhoff, 1996; Madaus, 2005; Vogel, Fresko, Wertheim, 2007; Webb & Farivar, 1994). Cooperative learning activities may develop effective elaboration skills “through mutual feedback and debate, peers motivate one another to abandon misconceptions and search for better solutions; the experience of peer interaction can help a child master social processes, such as participation and argumentation, and cognitive processes, such as verification and criticism; collaboration between peers can provide a forum of discovery learning and can encourage creative thinking; and “peer interaction can introduce children to the process of generating ideas” (Slavin, 1996, pp. 49-50). This environment also allows the teacher insight into the students’ thinking (NCTM, 2003) and provides the teacher with the opportunity to foster the discussions by extending wait time, allowing students to correct one another, asking more questions, supporting reticent speakers, encouraging the use of recording sheets, and summarizing ideas.

This type of classroom environment fosters the ability for students to develop reasoning skills. “Mathematical reasoning develops in classrooms where students are encouraged to put forth their own ideas for examination” (NCTM, 2000, p. 188).

Research has indicated that students can learn effective discourse through practice and reinforcement (Cohen, 1996; Cobb, Boufi, McClain, & Whitenack, 1997). Their studies showed that mathematics reasoning may be enhanced through using arguments and developing a norm for that behavior. Further questioning of students, such as ‘why?’ and ‘what other ways could you have solved that problem?’ stimulate further reasoning.

The National Council of Teachers of Mathematics advocates cooperative learning because "small groups provide a forum in which students ask questions, discuss ideas, make mistakes, learn to listen to others' ideas, offer constructive criticism, and summarize their discoveries in writing" (NCTM, 1989, p. 79). Effective teacher-intervention strategies used in cooperative-learning mathematics classroom include (a) adapting teacher instruction to students' needs, (b) focusing on cognitive and metacognitive aspects, and (c) combining teacher and peer resources (Dekker & Elshout-Mohr, 2004).

Research has shown that students benefit academically and socially from cooperative learning in mathematics (Ross, 1995; Whicker, Nunnery, & Bol, 1997). Fifth grade students of mixed ability level participated in one study investigating the effects of small cooperative learning groups on achievement. Results showed not only an increase in mathematics performance, but also the students’ willingness and response to each other’s needs for assistance. In a similar study, Sharan and Shachar (1988) and Shachar and Sharan (1994) reported similar results, finding that increased participation in group discussions resulted in more valuable individual contributions to these discussions. The discourse elicited by the cooperative learning environment provides students with increased points of view and ways of looking at mathematics, thereby increasing

students' metacognition. Metacognitive aspects involve students' ability to self-monitor cognitive processes like perception, action, memory, reasoning or emotions.

### **Self-Monitoring**

Self-monitoring approaches were first described by Meichenbaum and Goodman (1969, 1988) as part of cognitive approaches to student learning. Students use self-regulation to complete tasks as the basis of metacognition. Metacognitive planning and self-monitoring of educational tasks facilitate learning for students with disabilities (Clark, Deshler, Schumaker, Alley, & Warner, 1984; Deshler, Warner, Schumaker, & Alley, 1984; Ellis, 1994; Ellis, Deshler, & Schumaker, 1989; Montague, 1992; Montague & Leavell, 1994). Self-monitoring, such as metacognitive strategies, provide students with self-questioning techniques for problem solving (Montague & Bos, 1990) and is necessary for algebra success (Maccini, McNaughton, & Ruhl, 1999). Good problem solvers monitor their thinking regularly and automatically (Van de Walle, 2004). Metacognitive instruction, based on several decades of research, should be incorporated into teaching practices and will prepare students to plan, organize, and complete assignments with greater success (Ashton, 1999; Day & Elksnin, 1994; Gregory & Chapman, 2002; Mastropieri & Scruggs, 1998; McTighe, 1990). Developing students' ability for creative and deep thinking requires instruction that elicits drawing from previous knowledge, encourages elaboration, elicits multiple solutions, and extends students' thinking.

Essential strategies have been identified to elicit deep thinking about mathematic ideas (See Figure 2) (Fraivillig, 2001). "Self-regulated learners believe that academic



learning is a proactive activity, requiring self-initiated motivational and behavioral processes as well as metacognitive ones” (Zimmerman, 1998, p.1).

Strategies to Elicit Students’ Thinking
<ul style="list-style-type: none"> <li>• Elicit many solution methods for one problem</li> <li>• Wait for, and listen to, students’ descriptions of solution methods</li> <li>• Encourage students to elaborate and discuss</li> <li>• Use students’ explanations as a basis for the lesson’s content</li> <li>• Convey an attitude of acceptance toward students’ errors and efforts</li> <li>• Promote collaborative problem-solving</li> </ul>
Strategies to Support Students’ Thinking
<ul style="list-style-type: none"> <li>• Remind students of conceptually similar problems</li> <li>• Provide background knowledge</li> <li>• Lead students through instant replays (revisit student solutions)</li> <li>• Write symbolic representations of solutions when appropriate</li> </ul>
Strategies to Extend Students’ Thinking
<ul style="list-style-type: none"> <li>• Maintain high standards and expectations for all students</li> <li>• Encourage students to make generalizations</li> <li>• List all solution methods on the board to promote reflection</li> <li>• Push individual students to try alternative solution methods</li> <li>• Promote the use of more efficient solution methods</li> </ul>

*Figure 2. Thinking Strategies*

This type of problem-solving will develop students’ conceptual knowledge and allow transference to other subject areas. Several studies have examined the relationship between metacognitive training and mathematics reasoning (Mevarech & Kramarski, 1997; Schenfeld, 1985).

Research studies have shown that students using metacognitive instructional strategies significantly outperformed other students. A common element of the studies is using small groups to formulate and solve self-addressed metacognitive questions focusing on the nature of the problem, the relationship between prior and new knowledge, and strategies used to solve the problem appropriately (Kramarski & Mevarech, 2003). In other research, third grade students in one study showed an increase in metacognitive skills and improved problem solving in mathematics (Goldberg & Bush, 2003). Additionally, students showed a slight increase in planning and evaluation skills. The necessity for students to possess metacognitive skills increases with the difficulty of the concept to be learned.

The use of the instructional practices that have been discussed will be investigated in this study. It will be determined if a difference is present between general and special educators' use of, as well as teachers' perceptions of their preparedness to implement the research-based instructional practices.

### Teacher Quality and Knowledge

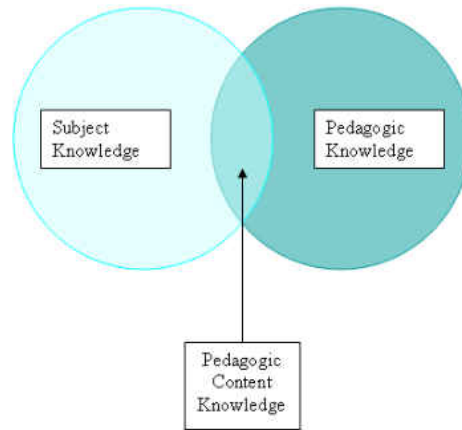
“Successful teachers cannot simply have an intuitive or personal understanding of a particular concept, principle, or theory. Rather, in order to foster understanding, they must themselves understand ways of representing the concepts for students” (Wilson, Shulman, & Richert, 1987, p. 112). Both NCLB and IDEA require highly qualified teachers to provide meaningful learning opportunities to students. Recent reforms in legislation and content standards in mathematics demand deep understanding of mathematical pedagogical content knowledge. The basis of pedagogical content knowledge (PCK) is subject matter, pedagogical knowledge, and content knowledge to

be effective (Shulman, 1986). “Pedagogical content knowledge is a subset of the content knowledge that has particular utility to planning and conducting lessons that facilitate learning” (Grouws & Schultz, 1996, p.444). Furthermore, pedagogical content knowledge includes “an understanding of how particular topics, problems, or issues are organized, presented, and adapted to the diverse interests and abilities of learners, and presented for instruction” (Shulman, 1987, p.8). Teacher education in the recent decades have focused more on pedagogy and less on content knowledge (Ball & McDiarmid, 1990). Referring to the depleting scores on international tests however, researchers have called for an increase in teachers’ content knowledge both at the preservice and inservice levels.

Pedagogical content knowledge “represents a class of knowledge that is central to teachers’ work and that would not typically be held by non-teaching subject matter experts or by teachers who know little of that subject” (Marks, 1990, p.9). Pedagogical content knowledge is where the subject knowledge and pedagogical knowledge overlap (See Figure 3), where the facilitation of learning begins.

According to Shulman’s theoretical framework (1986), teachers need to master two types of knowledge: (a) content, also known as ‘deep’ knowledge of the subject itself, and (b) knowledge of the curricular development. “If beginning teachers are to be successful, they must wrestle simultaneously with issues of pedagogical content (or knowledge) as well as general pedagogy (or generic teaching principles)” (Grossman, as cited in Ornstein, Thomas, & Lasley, 2000, p.508). The Model of Pedagogical Reasoning, created by Shulman (1986, 1987, 1992) provided activities that teachers should complete

in order to be effective: comprehension, transformation, instruction, evaluation, reflection, and new comprehension.



*Figure 3. Model of Pedagogical Reasoning*

Several studies have demonstrated that teachers which have been certified through alternative certification programs have faced difficulties with pedagogical content knowledge (Darling-Hammond, 1991). The research findings have shown that teachers that were traditionally prepared had greater PCK than their counterparts that were alternatively certified. A research study of first- and third-grade teachers and their students reported that the teachers' content knowledge significantly predicted student gains (Hill, Rowan, & Ball, 2005).

Though mathematical competency is a key factor in mathematics instruction, it takes much more to be an effective teacher. Teachers struggle to transfer visions of reform to practice (Ball, 1990; Cohen, 1990; Manouchehri & Goodman, 1998; Steele, 2001; Wilson & Lloyd, 2000; Wilson, 1990).

Other studies have determined that teacher quality is a main factor in the success rate of students (Sclafani, 2002; Strahan, 2003). “Special educators”, therefore, “cannot consider their pedagogical expertise as content enabling them to be called highly qualified” (King-Sears, 2005, p. 187). Thus, with many special education positions being in self-contained settings teaching multiple subjects, NCLB requirements may be unreasonable and deter would-be special educators (Hyatt, 2007), but the majority will still be required to meet the standards (Apling & Jones, 2005; National Conference of State Legislators, 2005).

Mooney, Denny, and Gunter (2004) expressed concern with the process of how numerous states were verifying teachers as highly qualified. They reported that states were allowing educators to test out with a standardized test rather than completing any teacher preparation program or obtain certification through alternative certification programs. Alternative certification programs are increasing in popularity. This remains a controversial topic as well, due to research findings reporting alternative certification programs are faster, but did not prepare sufficiently (Moore, Johnson, & Birkeland, 2006). Great concern has surmounted due to alternative certification routes.

Nougaret and Scruggs (2004) compared the reported teaching competencies of 40 first-year teachers, 20 traditionally prepared and 20 alternatively-certified. They found highly significant differences in planning and preparation for instruction, classroom environment, and instruction, with the teachers traditionally- licensed outperforming the alternatively-licensed. If there truly are differences in teacher efficacy, student achievement and outcomes may be compromised. Student success is highly dependent upon instruction and the teacher’s ability to relay information.

Research findings suggests that content knowledge, particularly in mathematics, has a greater impact on student achievement (Porter-Magee, 2004). For example, a teacher with a degree in math “has a statistically significant positive impact on students’ achievement compared to teachers with no advanced degree” (Goldhaber & Brewer, 2000, p. 130). Research results, however, are inconclusive on the amount of content knowledge needed. Concurrently, in another analysis they found that “fully certified teachers do not appear to be more effective than those holding emergency credentials” (Goldhaber & Brewer, 2003, p. 52).

### Teacher Preparation

Current concern highlights teacher preparation programs. There is a fear that pedagogy regarding students with learning disabilities may fall by the wayside in an effort to fulfill content-area knowledge requirements. The Council for Learning Disabilities (CLD) urges the awareness that “special education teaching is not like subject-matter instruction” and that “regardless of type of program, the content of teacher preparation programs must be grounded in research and directly related to positive student outcomes” (2000, p.130).

The Tennessee Value-Added Assessment System research suggested that a series of ineffective teachers can have a severe detrimental effect (Sanders & Horn, 1998). The mandate for highly qualified has both strengths and weaknesses. The primary strength of the mandate is the link that it recognizes between the quality of the teacher and the outcomes of the students. The effects of the teacher far overshadow classroom variables such as previous achievement level of students (Rivers & Sanders, 2002). More specifically, their research showed that students who had ineffective instruction scored

approximately 50% below peers with effective instruction. A teacher's effect on student achievement is measurable at least four years after students have left that teacher (Rivers & Sanders, 2002). The inference of the research is that the harm that ineffective instruction (a poor teacher) can do is detrimental to a student's educational career.

Teachers must be able to present content area knowledge as well as have the pedagogical knowledge to be able to provide strategies and interventions in an effort to reach students with LD. Research supports that "the most consistent highly significant prediction of student achievement...is the proportion of well-qualified teachers in a state: those with full certification and a major in the field they teach" (Darling-Hammond, 1999, p. 38). The implementation of research-based instructional practices consistent with NCTM standards in middle school mathematics, by highly qualified educators, to develop conceptual understanding of students with learning disabilities is imperative and will require teachers to have knowledge in both content and pedagogy.

### Implications

In the 1970s and 1980s, it was determined that the implementation of research-based practices was limited because researchers were "teaching teachers how to behave without articulating fully their own assumptions about why this would be a superior way to behave" (Kennedy, 1997, p.6). Teachers did not fully comprehend the underlying principles of the research-based practices. "Teachers must have deep knowledge about a practice" (Vaughn, Klingner, & Hughes, 2000, p. 169) if they are to continue to use it.

Results of survey research conducted with 167 special and general educators showed significant differences existed in mathematics instruction when comparing general and special educators (Gagnon & Maccini, 2007). More general educators held

mathematics teaching credentials. Special educators were almost eight times more likely to teach basic mathematics skills to students with learning disabilities, whereas general educators were twice as likely to teach higher-level mathematics to students with learning disabilities. Special education teachers reported less familiarity with upper-level mathematics and limited use of instructional practices supported by NCTM. General educators reported less familiarity with pedagogical strategies such as student grouping. A recommendation from this study was the need for continued mathematics professional development for both general and special educators.

This study differed in several ways from the original study. The current research explored the pedagogical content knowledge of middle school teachers who teach students with learning disabilities. Further teacher preparation, knowledge, and use of specific research-based instructional practices aligned with NCTM standards (e.g., Direct Instruction, graduated instruction, grouping practices, and self-monitoring) will be collected, analyzed, and reported. Similar to Gagnon and Maccini's research, comparisons of teacher preparation, instructional practices, and perceptions of classroom implementation by middle school general and special education teachers will be reported. Although there were differences between the original and current studies, the focus of both was to investigate educators' reported use of and preparation to use research-based instructional practices for students with difficulties in mathematics. Differences between the two instruments will be discussed in Chapter 3.



## CHAPTER THREE: METHODOLOGY

### Introduction

The purpose of this quantitative study was to investigate the differences in the implementation of research-based instructional practices specifically between general and special education teachers in middle schools. This chapter describes the primary research questions, research methodology, and participants in this study. Next, the instrument's validity and reliability are discussed, including the dependent and independent variables. Lastly, an explanation of the data collection methods and an overview of the data analyses are provided.

The use of research-based instructional strategies in mathematics to teach algebraic thinking skills can greatly impact students' success (Burns, 2002; Gickling, Shane, & Croskery, 1989; House, 2001, 2002, 2006; National Research Council, 2001; Witzel, 2001, 2005; Witzel, Mercer, & Miller, 2003). Research to determine the factors related to classroom implementation of research-based mathematic instruction and strategies by both general and special educators is needed (Maccini & Gagnon, 2006; Loucks-Horsley, Hewson, Love, & Stiles, 1998).

Specifically, this research was conducted to answer the following questions:

1. How do instructional practices in mathematics differ between general and special educators in middle school classrooms?
2. How do general and special educators perceive their preparation to use research-based instructional practices in their middle school classrooms?

The methods for data collection and analyses described throughout this chapter have been conducted to address these questions to gain insight of implementation of research-based instructional practices in mathematics for middle school general and special educators. Teacher characteristics were analyzed across teacher type (general or special educator).

### Setting

This study was conducted in two school districts in Florida. One district is in central Florida serving more than 65,000 students with over 9,000 employees. It is a mid-sized school district. There are approximately 115 general and special educators in twelve middle schools assigned to teach mathematics. The second school district is a large-sized school district in central Florida serving more than 175,000 students with nearly 9,000 employees. There are 29 middle schools in this district, with 318 general and special educators combined that teach mathematics. Therefore, approximately 433 teachers were invited to take the online survey. Queries regarding the school demographics reported that overall, educators taught in suburban settings with the average student population at over 1,000 students. The two school districts were chosen so that a diverse student and teacher population were represented.

### Participants

Convenience sampling was employed to determine the two school districts and population that would be used in the current study. Teacher demographics between the large and mid-sized school district may be found in Table 3.

Table 3. Teacher Demographics of the Two School Districts

<b>Gender</b>	<b>General Educators</b>	<b>%</b>	<b>Special Educators</b>	<b>%</b>
Male	17	19.8	0	0
Female	66	76.7	27	100
Non-Responses	3	3.5	0	0
<b>Ethnicity</b>	<b>General Educators</b>	<b>%</b>	<b>Special Educators</b>	<b>%</b>
African-American	4	4.7	4	14.8
Pacific Islander	1	1.2	0	0.0
Hispanic	4	4.7	1	3.7
White	71	82.4	19	70.4
Multi-racial	0	0.0	1	3.7
Non-Responses	6	7.0	2	7.4
<b>Highest Education Completed</b>	<b>General Educators</b>	<b>%</b>	<b>Special Educators</b>	<b>%</b>
Bachelor's Degree	43	50.0	16	59.3
Master's Degree	31	36.0	7	25.9
Specialist Degree	3	3.5	2	7.4
Doctoral Degree	5	5.8	1	3.7
Non-Responses	4	4.7	1	3.7
<b>Math Teaching Certified</b>	<b>General Educators</b>	<b>%</b>	<b>Special Educators</b>	<b>%</b>
Yes	67	77.9	13	48.1
No	13	15.1	14	51.9
Non-Responses	6	7.0	0	0.0
<b>How Certification Achieved</b>	<b>General Educators</b>	<b>%</b>	<b>Special Educators</b>	<b>%</b>
4 yr. college	48	55.8	17	63.0
Alternative Cert.	23	26.8	4	14.8
Certification Test	10	11.6	6	22.2
Non-Responses	5	5.8	0	0.0

<b># of Math Courses Taken</b>	<b>General Educators</b>	<b>%</b>	<b>Special Educators</b>	<b>%</b>
None	13	15.1	1	3.7
1-2	35	40.7	13	48.1
3 or more	35	40.7	13	48.1
Non-Responses	3	3.5	0	0.0
<b>Years Taught Mathematics</b>	<b>General Educators</b>	<b>%</b>	<b>Special Educators</b>	<b>%</b>
1-3	26	30.2	9	33.3
4-6	23	26.7	6	22.2
7-9	7	8.1	4	14.8
10 or more	25	29.2	8	29.6
Non-Responses	5	5.8	0	0.0
<b>Years Taught Students with LD</b>	<b>General Educators</b>	<b>%</b>	<b>Special Educators</b>	<b>%</b>
1-3	31	36.0	4	14.8
4-6	18	20.9	6	22.2
7-9	7	8.2	4	14.8
10 or more	24	27.9	12	44.4
Non-Responses	6	7.0	1	3.7

### Instrumentation

The data in this study were collected using an instrument, adapted with permission, from a survey developed by Joseph Calvin Gagnon, Ph.D. and Paula Maccini, Ph.D (See Appendix A). Separate surveys were originally developed for general and special educators based on previous research (Maccini & Gagnon, 2000, 2002), however this study did not use the original survey in its entirety. The initial research and survey was mailed to a sample of middle school and high school mathematics educators which was obtained from the Quality Education Data (QED) database. The original survey queried educators about students with learning disabilities and emotional/behavior disorders.

The current research was a systematic replication study, which is a study that varies from the original study in minor aspects. Comparisons of the original and systematic replication study may be seen in Table 4.

*Table 4. Comparison of Original Study and Systematic Replication Study*

	<b>Original Study</b>	<b>Systematic Replication Study</b>
<b>Setting (Sample)</b>	National	Two school districts in Florida
<b>Participants</b>	General and special educators who teach mathematics to both LD and EBD	General and special educators who teach mathematics to LD
<b>Survey Administration</b>	Mail	Online
<b>Type of Research:</b>	Quantitative and Qualitative	Quantitative only
<b>Variables</b>	Predictors: <ul style="list-style-type: none"> <li>• Years teaching students with LD/EBD</li> <li>• Knowledge</li> <li>• Number of Methods Course</li> </ul> Criterion: <ul style="list-style-type: none"> <li>• NCTM standards</li> <li>• Direct instruction</li> <li>• Graduated instruction</li> <li>• Grouping practices</li> </ul>	Predictors: <ul style="list-style-type: none"> <li>• General educator</li> <li>• Special educator</li> </ul> Criterion: <ul style="list-style-type: none"> <li>• NCTM standards</li> <li>• Direct instruction</li> <li>• Graduated instruction</li> <li>• Grouping practices</li> <li>• Self-monitoring</li> </ul>
<b>Content of Survey:</b>	Three sections: <ol style="list-style-type: none"> <li>1. Demographics</li> <li>2. Use of Instructional Practices</li> </ol>	Three sections: <ol style="list-style-type: none"> <li>1. Demographics</li> <li>2. Use of Instructional Practices</li> </ol>

<b>Content of Survey</b>	3. Perceptions of preparedness to use instructional practices	3. Perceptions of preparedness to use instructional practices
<b>Research Questions:</b>	<ol style="list-style-type: none"> <li>1) How prepared do teachers perceive they are to use instructional strategies consistent with NCTM, self-monitoring, direct instruction, graduated instruction, and student groupings, and how often do they use instructional strategies consistent with these approaches?</li> <li>2) What factors contribute to teacher use of instructional strategies consistent with NCTM, direct instruction, graduated instruction, and student groupings?</li> </ol>	<ol style="list-style-type: none"> <li>1) How do instructional practices in mathematics differ between general and special educators in the middle school classroom?</li> <li>2) How do general and special educators perceive their preparation to use research-based instructional practices in their middle school classrooms?</li> </ol>

The survey adapted for this research was entitled *Research-based Instructional Practices in Mathematics* and consisted of three sections. The first section was designed to collect demographic data. The second section focused on educators' self-reported use of instructional practices in their classrooms. The questions related to instructional practices utilized a 4-point Likert scale ranging from 1=Never to 4=Daily. All Likert scale responses utilized a radio-button which allows for only a single response per question. The third section addressed the educators' perceptions of preparedness to use the instructional practices. Within the questions related to teacher familiarity with teacher preparedness, responses were limited to prepared or unprepared.

## Variables

The predictor variables of the current study were the type of educator (general or special). The criterion variables of the current study were the instructional practices (aligned with NCTM standards, aligned with direct instruction, aligned with graduated instruction, aligned with grouping practices, and aligned with self-monitoring).

## Validity and Reliability

Validity refers to “the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration” (Babbie, 1990, p. 133). Content validity can be determined by individuals that have expertise in subject of study (Gay, Mills, & Airasian, 2006; Litwin, 1995). In the original study, survey validity was addressed in the original survey through teacher focus groups. The teachers responded to clarify objectives, appropriateness of questions, and format (Gagnon & Maccini, 2007). Additionally, the original researchers utilized consultants from the Survey Research Center to review the surveys to address the construct validity and methodology. Modifications to the original survey and methodology were made based on the feedback received by the original researchers. Content of the current survey was taken from the original survey and was not used in its entirety.

Instrument reliability is the degree that an instrument is consistent (Gay, Mills, & Airasin, 2006; Schutt, 2006). In an effort to maximize the reliability of an instrument, it is important to “ask people only questions that they are likely to know the answers to, ask about things relevant to them, and be clear in what you’re asking” (Babbie, 1990, p. 133). Reliability of the original survey was addressed using three approaches. Primarily, standardized directions were given. Second, reliability for data entry was tested on 25%

of the responses. Third, multiple items were used to measure the associations of questions using Cronbach's coefficient alpha. This is an estimate of inter-item consistency commonly used to determine the reliability of items in a given construct on a survey instrument (Dillman, 2007). Coefficient alpha numbers approaching 1.00 represent good inter-item consistency, while numbers approaching 0.00 indicate poor inter-item consistency. Similar analysis was conducted using Cronbach's Coefficient Alpha for the current research and reported in Chapter 4. The current survey provided standardized directions as well. Data entry was not necessary, since the online survey tool compiles the data based on the participants' responses. The data can then be placed directly into SPSS and analyzed. The criterion variables which will be analyzed for inter-rater reliability are: aligned with NCTM standards, aligned with direct instruction, aligned with graduated instruction, aligned with student grouping, and aligned with self-monitoring.

### Procedures

The details and specifications of this research study were submitted to the University of Central Florida's Institutional Review Board (IRB). Following permission granted from IRB to conduct the study, (See Appendix B), a detailed explanation, summary of the problem, and data collection methods were submitted to each of the school district's Supervisor of Measurement and Data Analysis requesting permission to conduct the research. After approvals from the school districts (See Appendices C and D) were received, the Informed Consent Letter was provided to participants (See Appendix E). The Informed Consent Letter explained the purpose of the study, assuring the confidentiality of each participant. This letter welcomed participants to take the



survey by hyperlinking to the Survey Monkey website where the revised survey (See Appendix F) was located. Dissemination of the Informed Consent Letter in the large-sized county was done through via email. The letter was forwarded to the Secondary Mathematics Curriculum Specialist, who forwarded along to her colleagues. The mid-sized school district, however, did not allow email contact. Therefore, the researcher delivered hard copies of the letter directly to the middle schools.

#### Data Collection

Participants accessed the survey via a link provided to them for SurveyMonkey. SurveyMonkey.com is an online survey designer. Using the web browser, the researcher created the survey using the survey editor. The designer allowed the creator to select the type of question (e.g., multiple choice, comment box, rating scale, etc.). Additionally, the creator could have controlled the flow of questioning with custom skip-logic as well as randomized answer choices to eliminate bias. Following Dillman's (2007) Tailored Design, the randomizer option was not employed. The survey did not employ skip-logic; however, the researcher opted to give the respondents the opportunity to answer all questions or skip questions themselves. Skip-logic, or branching, allows custom paths to be created throughout a survey. The survey creator also has the ability to control color, size, and style of the survey. It is possible, with SurveyMonkey.com, to send the survey via email using a list management tool and track responses. With this option, follow-up reminders and opt-outs could have been automatically managed. Downloading results is possible in multiple formats, however EXCEL was utilized for smooth transfer into the SPSS statistics software. The SurveyMonkey.com website is guaranteed 'Hacker Safe' and tested daily to ensure confidentiality. Upon entering the SurveyMonkey website, the

survey appeared in a single window with respondents able to opt out of answering any questions they chose not to answer. Multiple questioning tactics were used and questions were not randomized. Open-ended questions were provided following each instructional practice in an effort to strengthen the instrument's fidelity. Upon clicking the submit button, the participants were thanked for their participation.

After three weeks, the survey window was closed and the number of respondents was forwarded to Random.org. Random.org is a True Random Number Generator (TRNG) using Hotbits. HotBits are “generated by timing successive pairs of radioactive decays detected by a Geiger-Müller tube interfaced to a computer, and brings genuine random numbers, generated by a process fundamentally governed by the inherent uncertainty in the quantum mechanical laws of nature” (Fourmilab, 2007, p. 1), or white noise. The first 10-percent of the randomized list was used to assess face validity of the instrument. Any respondent that did not fill in the comments section was skipped and the next random number was chosen. At the end of the survey was a submit button.

### Data Analysis

After gathering the survey results from participating teachers, a database was created. The Statistical Package for Social Sciences (SPSS) was used to analyze the data. The criterion variables (aligned with NCTM standards, aligned with direct instruction, aligned with graduated instruction, aligned with student grouping, and aligned with self-monitoring) were analyzed using Cronbach's coefficient alpha to determine the internal consistency reliability of each category. Internal consistency reliability is the degree which the change in the criterion variable is produced by the predictor variable and not an extraneous factor (Vogt, 2007). A chi-square analysis was conducted between teacher

type (general and special educator) and gender to determine statistical significance using a two-by-two contingency table. Next, independent-samples t-tests were used to compare the mean scores of the predictor variables (general and special educators) for both use of instructional practices and preparedness to use the instructional practices. Levene's test for equality of variances was conducted to determine whether the variance of scores for the two groups was the same. Based on Levene's test for equality of variances, equal variances were not automatically assumed. Therefore, if the data violated the assumptions of equal variance, the alternate t-value compensated for variances not being equal. Findings of this study have been reported in Chapter 4.

## CHAPTER FOUR: RESULTS

### Introduction

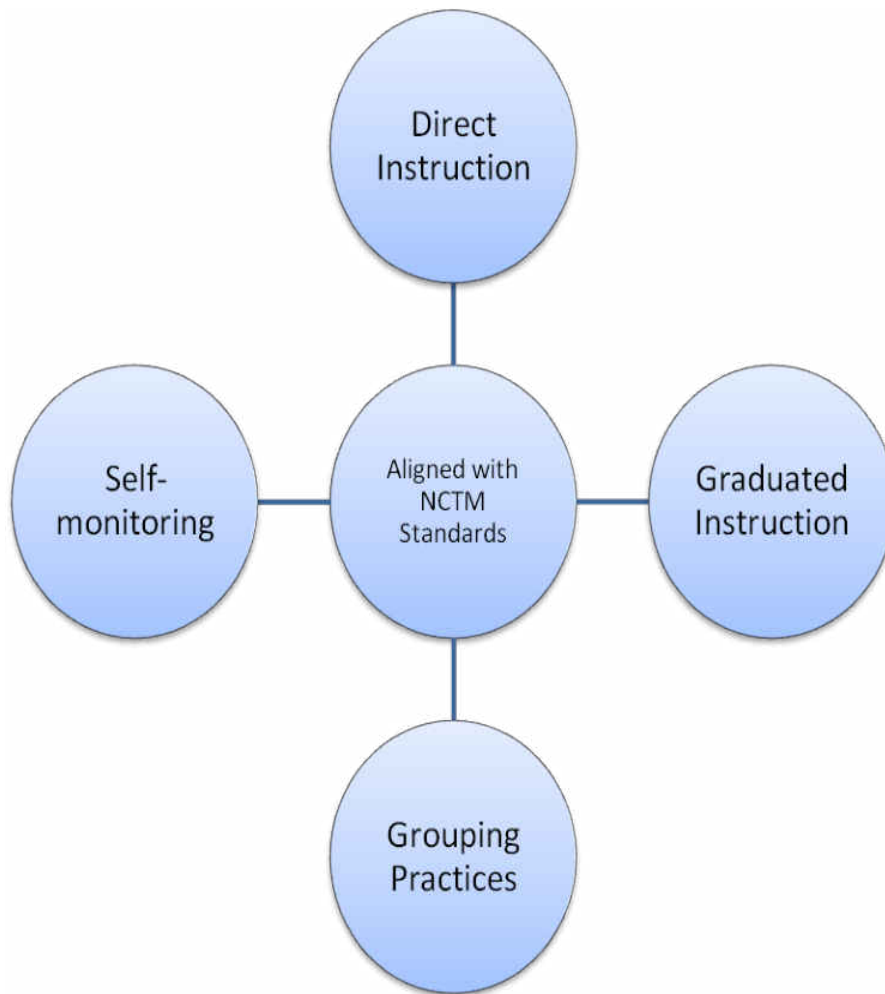
The purpose of this study was to investigate the differences between general and special educators regarding the implementation of research-based instructional practices that target the needs of students with LD in mathematics, as well as general and special educators' perceptions of their preparedness to use instructional practices in mathematics. The primary objective was to investigate the differences between general and special educators regarding the reported implementation of research-based instructional practices for students with learning disabilities in mathematics. Additionally, an inquiry into general and special educators' perceptions of their preparedness to use instructional practices in mathematics was conducted. This chapter presents the results of the data analyses for each of the following research questions:

- 1) How do instructional practices in mathematics differ between general and special educators in middle school classrooms?
- 2) How do general and special educators perceive their preparation to use research-based practices in their middle school classrooms?

### Overview of Data Analysis

Information regarding five instructional practices was gathered from the survey responses. The survey consisted of three main sections: demographics, the use of instructional practices, and the preparedness to use the instructional practices. The second and third sections were comprised of 22 identified instructional strategies, divided into five sections, based on the alignment with individual instructional practices that have been validated for students with learning disabilities (the criterion variables, See Figure

4). Within section two, participants responded to questions using a 4-point Likert scale ranging from 1=Never to 4=Daily. Within the third section of the survey, participants responded using a 2-point Likert scaled comprised of 1=Prepared and 2=Unprepared.



*Figure 4. Five Instructional Practices Validated for Students with Learning Disabilities*

## Response Rate

The response rate of the current research was 113 general (n=86) and special (n=27) educators. The response rate, for the current research, equaled 26% of the sample size of middle school general and special educators. This is within the accepted and published return rates for online surveys. Recent research has shown a decline in online survey response rate, averaging just above 20% (Pulseware, 2008). Additional research has shown a 19% online survey response rate (Schuldt & Totten (1994) and a 21% global online response rate (Swoboda, Muehlberger, Weitkunat, & Schneeweiss, 1997). The response rates were calculated across the two counties due to anonymity of the survey. Using Dillman's (2007) formula, a 6.5% sampling error was tolerated. A sampling error is the error caused by observing a sample instead of the entire population.

## Inter-Item Consistency

Cronbach's coefficient alpha was calculated to determine inter-item consistency reliability of the instructional practices based on standardized items (See Table 5). Cronbach's Coefficient Alpha attempts to measure the reliability associated with the variation accounted for by the true score of the underlying construct. Construct is the hypothetical variable that is being measured (Hatcher, 1994). Failure to meet the assumption of tau-equivalence, however, results in Cronbach's Coefficient Alpha underestimating the reliability of measured scores.

Table 5. Inner-Item Consistency

Instructional Practice	Cronbach's Coefficient Alpha
NCTM	.638
Direct Instruction	.663
Graduated Instruction	.686
Grouping Practices	.615

By convention, a lenient cut-off of .60 is common in research. Moderate inter-item consistency was present throughout the four grouped instructional practices. A possible reason for the measures not being higher is the limited number of items in each variable. Increasing the amount of items, in general, increases the inter-item consistency. Self-monitoring consisted of one strategy and therefore did not require this analysis. Internal validity was determined to be sufficient to maintain the criterion variable groupings.

#### Demographics

One hundred thirteen general and special educators participated in the current survey research. Statistically significant differences existed for general ( $M=1.80$ ,  $SD=.401$ ) and special educators ( $M=2.00$ ,  $SD=.000$ ),  $\chi^2(2, N=108)=6.261, p=.01$  regarding gender. Significant differences were also reported concerning mathematics teaching certification, with general educators ( $M=1.16$ ,  $SD=.373$ ) holding mathematics teaching certification more often than special educators ( $M=1.52$ ,  $SD=.509$ ),  $t(36.016)=-3.320, p<.01$ . Additionally, a statistically significant difference was present regarding the number of years teaching students with LD, general educators ( $M=2.33$ ,  $SD=1.266$ ) and special educators ( $M=2.92$ ,  $SD=1.164$ ),  $t(102)=-2.098, p=.04$ .

Prior to questions regarding the use of instructional practices, educators were asked if they were aware of NCTM standards and if they referred to NCTM standards when planning mathematics instruction. There was a statistically significant difference in scores for general educators ( $M=1.01$ ,  $SD=.120$ ) and special educators ( $M=1.25$ ,  $SD=.442$ ),  $t(24.195) = -2.575$ ,  $p=.02$ . The magnitude of the differences of the means was moderate ( $\eta^2 = .07$ ).

### Question One

In this section, the results of the survey pertaining to the use of instructional practices of general and special educators have been presented. These analyses address the first research question: How do instructional practices in mathematics differ between general and special educators in middle school classrooms?

#### Results

An analysis of comparisons between general and special educators concerning the five instructional practices was conducted. No statistical significances resulted when comparing general and special educators' use of the 22 strategies grouped into the five respective instructional practices. Descriptive statistics depicting the percentage of use of instructional strategies may be compared between general educators (See Table 6) and special educators (See Table 7).



Table 6. General Educators' Reported Use of Instructional Strategies in Percentages

<b>Aligned with NCTM Standards</b>	<b>Never</b>	<b>Seldom</b>	<b>Occasionally</b>	<b>Daily</b>
Encourage problem solving strategies	0.0	1.35	17.57	81.11
Demonstrate use of graphing calculator	44.44	23.61	23.61	8.33
Embed math in real-world tasks	0.0	1.37	41.10	57.53
Encourage discussions of problem solving approaches	0.0	6.85	26.03	67.12
Illustrate concepts via multiple models	0.0	0.0	34.25	65.75
<b>Aligned with Direct Instruction</b>	<b>Never</b>	<b>Seldom</b>	<b>Occasionally</b>	<b>Daily</b>
Provide teacher modeling of a concept	0.0	0.0	0.0	100.00
Provide feedback and reinforcement	0.0	0.0	6.76	93.24
Incorporate mastery learning before advancing	0.0	15.07	56.16	28.77
Provide review of previously learned concepts	0.0	0.0	37.84	62.16
Provide independent practice	0.0	1.37	17.81	80.82
Provide cumulative reviews	2.74	10.96	64.38	21.92
Graph student progress to make instructional decisions	35.14	22.98	32.43	9.46
Give advance organizers for a new lesson	13.51	16.22	50.00	20.27
Encourage practice of basic math skills	0.0	10.81	20.27	68.92
<b>Aligned with Graduated Instruction</b>	<b>Never</b>	<b>Seldom</b>	<b>Occasionally</b>	<b>Daily</b>
Demonstrate a concept representationally	1.35	4.05	77.03	17.57
Demonstrate a concept concretely	0.0	0.0	84.85	15.15
Use tools representing all levels of learning	0.0	6.76	64.86	28.38

<b>Aligned with Grouping Practices</b>	<b>Never</b>	<b>Seldom</b>	<b>Occasionally</b>	<b>Daily</b>
Have students work in same-ability groups	14.67	24.00	49.33	12.00
Provide cooperative learning activities	0.0	8.11	58.11	33.78
Provide small-group assistance while others working	2.67	14.67	56.00	26.67
Provide opportunities for peer tutoring	2.70	17.57	55.41	24.32

*Table 7. Special Educators' Reported Use of Instructional Strategies in Percentages*

<b>Aligned with NCTM Standards</b>	<b>Never</b>	<b>Seldom</b>	<b>Occasionally</b>	<b>Daily</b>
Encourage problem solving strategies	0.0	0.0	7.69	92.31
Demonstrate use of graphing calculator	58.33	12.50	25.00	4.17
Embed math in real-world tasks	0.0	4.00	24.00	72.00
Encourage discussions of problem solving approaches	0.0	4.00	20.00	76.00
Illustrate concepts via multiple models	0.0	0.0	28.00	72.00
<b>Aligned with Direct Instruction</b>	<b>Never</b>	<b>Seldom</b>	<b>Occasionally</b>	<b>Daily</b>
Provide teacher modeling of a concept	0.0	0.0	0.0	100.00
Provide feedback and reinforcement	0.0	0.0	7.69	92.31
Incorporate mastery learning before advancing	0.0	15.38	61.54	23.08
Provide review of previously learned concepts	0.0	3.85	23.08	73.08
Provide independent practice	0.0	7.69	30.77	61.54
Provide cumulative reviews	4.17	12.50	62.50	20.83
Graph student progress to make instructional decisions	12.00	40.00	40.00	8.00

Give advance organizers for a new lesson	0.0	24.00	36.00	40.0
Encourage practice of basic math skills	0.0	16.00	8.00	76.0
<b>Aligned with Graduated Instruction</b>	<b>Never</b>	<b>Seldom</b>	<b>Occasionally</b>	<b>Daily</b>
Demonstrate a concept representationally	0.0	4.17	75.00	20.83
Demonstrate a concept concretely	0.0	0.0	78.26	21.74
Use tools representing all levels of learning	0.0	8.33	58.33	33.33
<b>Aligned with Grouping Practices</b>	<b>Never</b>	<b>Seldom</b>	<b>Occasionally</b>	<b>Daily</b>
Have students work in same-ability groups	8.33	16.67	58.33	16.67
Provide cooperative learning activities	4.17	0.0	54.17	41.67
Provide small-group assistance while others working	0.0	4.17	37.50	58.33
Provide opportunities for peer tutoring	4.17	25.00	37.50	33.33

Review of the self-reported use of instructional strategies showed that general and special educators employed the four instructional strategies, overall, ‘occasionally’ within their mathematics instruction. Additionally, both general educators (38.02%) and special educators (48.00%) reported only ‘occasionally’ using self-monitoring strategies. The next largest response for both groups was ‘never’ at (28.17%) for general educators and (24.00%) for special educators.

Independent Samples T-tests exhibited statistically significant differences between general and special educators within the individual strategies that are aligned with the five instructional practices. Two instructional strategies overall showed statistically significant differences between general and special educators (See Table 8).

Table 8. Statistically Significant Differences Between General and Special Educators in the Use of Instructional Strategies

<b>Instructional Practice</b>	<b>M</b>	<b>SD</b>	<b>t</b>	<b>P</b>
<b>Encourage Development of Problem Solving Strategies</b>				
General Educators	3.80	.440		
Special Educators	3.96	.204	(83.569)= -2.393	.02
<b>Provide Small Group Assistance</b>				
General Educators	3.07	.714		
Special Educators	3.54	.588	(95)= -2.934	<.01

Within the category of instructional strategies aligned with NCTM standards, the strategy ‘Encourage Development of Problem Solving Strategies’ exhibited a statistically significant difference between types of teachers. The magnitude of the differences in the means was moderate (*eta squared* =.06). The second instructional practice that showed a statistically significant difference in means was in the category of Direct Instruction. The strategy ‘Provide Small Group Assistance’ displayed a statistically significant difference with the magnitude of the differences in the means moderate (*eta squared* =.08). The strategies that did not reveal statistically significant differences in the mean scores of general and special educators’ use of instructional practices are displayed in Table 9.

Table 9. Instructional Practices of General and Special Educators That Were Not Statistically Significantly Different

<b>NCTM Aligned</b>	<b>M</b>	<b>SD</b>	<b>t</b>	<b>P</b>
<b>Demonstrating Graphing Calculator</b>				
General Educators	2.00	1.015		
Special Educators	1.75	.989	(91)=1.046	.30
<b>Embed Real World Tasks</b>				
General Educators	3.58	.497		
Special Educators	3.67	.565	(91)= -.712	.48
<b>Encourage Discussions of Approaches to Problem Solving</b>				
General Educators	3.62	.597		
Special Educators	3.71	.550	(91)= -.614	.54
<b>Illustrate Concept Via Multiple Models</b>				
General Educators	3.65	.480		
Special Educators	3.71	.464	(91)= -.498	.62
<b>Direct Instruction Aligned</b>	<b>M</b>	<b>SD</b>	<b>t</b>	<b>P</b>
<b>Provide Teacher Modeling</b>				
General Educators	4.00	.00		
Special Educators	4.00	.00		
<b>Provide Feedback and Reinforcement to Students</b>				
General Educators	3.91	.295		
Special Educators	3.94	.236	(69)= -.505	.62

<b>Incorporate Mastery Learning Before Advancing</b>				
General Educators	3.13	.621		
Special Educators	3.11	.583	(69)=.126	.90
<b>Provide Review of Previously Learned Concepts</b>				
General Educators	3.68	.471		
Special Educators	3.78	.428	(69)= -.784	.44
<b>Provide Independent Practice</b>				
General Educators	3.92	.267		
Special Educators	3.67	.594	(19.377)=1.782	.09
<b>Provide Cumulative Reviews</b>				
General Educators	3.15	.568		
Special Educators	3.11	.758	(69)=.235	.82
<b>Graph Student Progress to Make Instructional Decisions</b>				
General Educators	2.13	1.001		
Special Educators	2.44	.922	(69)= -1.166	.25
<b>Provide Advance Organizers For a New Lesson</b>				
General Educators	2.94	.908		
Special Educators	3.28	.826	(69)= -1.380	.172
<b>Encourage Basic Math Skills Practice</b>				
General Educators	3.68	.613		
Special Educators	3.78	.647	(69)= -.581	.56
<b>Graduated Instruction Aligned</b>	<b>M</b>	<b>SD</b>	<b>t</b>	<b>P</b>
<b>Demonstrate Concept Representationally</b>				
General Educators	3.15	.504		
Special Educators	3.22	.422	(87)= -.562	.58

<b>Demonstrate Concept Concretely</b>				
General Educators	3.15	.361		
Special Educators	3.22	.422	(87)= -.721	.47
<b>Use Tools Representing All Levels of Learning</b>				
General Educators	3.29	.489		
Special Educators	3.30	.559	(87)= -.134	.89
<b>Grouping Practices Aligned</b>	<b>M</b>	<b>SD</b>	<b>t</b>	<b>P</b>
<b>Have Students Work in Same Ability Groups</b>				
General Educators	2.58	.896		
Special Educators	2.83	.816	(95)= -1.249	.22
<b>Provide Cooperative Learning Activities</b>				
General Educators	3.26	.602		
Special Educators	3.33	.702	(95)= -.495	.62
<b>Provide Peer Tutoring Opportunities</b>				
General Educators	3.03	.726		
Special Educators	3.00	.885	(95)=.152	.88
<b>Self-Monitoring Aligned</b>	<b>M</b>	<b>SD</b>	<b>t</b>	<b>P</b>
<b>Teach Self-Monitoring Strategies</b>				
General Educators	2.38	1.047		
Special Educators	2.56	1.044	(94)= -.739	.462

## Summary

General and special educators utilize various instructional strategies aligned with NCTM standards, direct instruction, graduated instruction, grouping practices, and self-monitoring. After analyzing the self-reported data of the participants, only two statistically significant differences were highlighted. The strategy ‘Encourage Development of Problem Solving Strategies’ aligned with NCTM standards showed a statistically significant difference between general educators ( $M=3.80$ ,  $SD=.440$ ) and special educators ( $M=3.96$ ,  $SD=.204$ ),  $t(83.569) = -2.393$ ,  $p=.02$  with a moderate magnitude ( $\eta^2=.06$ ). Additionally, the strategy ‘Provide Small Group Assistance’ aligned with direct instruction also showed a statistically significant difference between general educators ( $M=3.07$ ,  $SD=.714$ ) and special educators ( $M=3.54$ ,  $SD=.588$ ),  $t(95) = -2.934$ ,  $p<.01$  with a moderate magnitude ( $\eta^2=.08$ ). Special educators, overall, reported greater use of all instructional strategies, with the exception of: demonstrating graphing calculators, incorporating mastery learning before advancing, providing independent practice, providing a cumulative review, and providing peer tutoring.

## Question Two

In this section, the results of the survey pertaining to the perceived preparedness to use instructional practices of general and special educators have been presented. These analyses address the second research question: How do general and special educators perceive their preparation to use research-based instructional practices in their middle school classrooms? Data regarding perceptions of the educators’ preparation of use of instructional practices in mathematics were analyzed from the survey responses.



## Results

Participants were asked the same questions in section three as in section two, with the addition of ‘Do you feel prepared to...’ Two instructional strategies overall showed statistically significant differences between general and special educators (See Table 10).

*Table 10. Statistically Significant Differences Between General and Special Educators in the Perceptions of Preparedness to Use Instructional Strategies*

<b>Instructional Practice</b>	<b>M</b>	<b>SD</b>	<b>t</b>	<b>P</b>
<b>Preparedness to Embed Math in Real World Tasks</b>				
General Educators	1.11	.313		
Special Educators	1.00	.000	(73)=2.975	<.01
<b>Preparedness to Provide Advance Organizers</b>				
General Educators	1.31	.468		
Special Educators	1.13	.344	(50.787)=2.021	.05

Again, only two strategies exhibited statistically significant differences in the mean scores of general and special educators. The strategy ‘Preparedness to Embed Math in Real World Tasks’ revealed a statistically significant difference between general educators and special educators. Additionally, the strategy ‘Preparedness to Provide Advance Organizers’ evidenced a statistically significant difference in general and special educators. Special educators reported greater perceptions of preparedness for both strategies. The strategies that did not reveal statistically significant differences in the

mean scores of general and special educators' perceptions of preparedness to use instructional practices are displayed in Table 11.

*Table 11. Perceptions of Preparedness of General and Special Educators To Use Instructional Practices That Were Not Statistically Significantly Different*

<b>NCTM Aligned</b>	<b>M</b>	<b>SD</b>	<b>t</b>	<b>P</b>
<b>Encourage the Development of Strategies</b>				
General Educators	1.05	.228		
Special Educators	1.04	.204	(96)=.237	.81
<b>Demonstrating Graphing Calculator</b>				
General Educators	1.58	.497		
Special Educators	1.75	.442	(43.378)= -1.576	.12
<b>Encourage Discussions of Approaches to Problem Solving</b>				
General Educators	1.05	.228		
Special Educators	1.04	.204	(96)=.237	.81
<b>Illustrate Concept Via Multiple Models</b>				
General Educators	1.11	.313		
Special Educators	1.17	.381	(96)= -.755	.45
<b>Direct Instruction Aligned</b>	<b>M</b>	<b>SD</b>	<b>t</b>	<b>P</b>
<b>Provide Teacher Modeling</b>				
General Educators	1.00	.00		
Special Educators	1.04	.209	(22)= -1.000	.33
<b>Provide Feedback and Reinforcement to Students</b>				
General Educators	1.03	.168		
Special Educators	1.00	.000	(91)=.814	.42

<b>Incorporate Mastery Learning Before Advancing</b>				
General Educators	1.33	.473		
Special Educators	1.22	.422	(41.680)=1.063	.30
<b>Provide Review of Previously Learned Concepts</b>				
General Educators	1.03	.168		
Special Educators	1.04	.209	(91)= -.347	.73
<b>Provide Independent Practice</b>				
General Educators	1.01	.120		
Special Educators	1.00	.000	(91)=.571	.57
<b>Provide Cumulative Reviews</b>				
General Educators	1.06	.234		
Special Educators	1.09	.288	(91)= -.500	.62
<b>Graph Student Progress to Make Instructional Decisions</b>				
General Educators	1.34	.478		
Special Educators	1.17	.388	(45.847)=1.707	.095
<b>Encourage Basic Math Skills Practice</b>				
General Educators	1.04	.204		
Special Educators	1.00	.000	(69)= 1.758	.08
<b>Graduated Instruction Aligned</b>	<b>M</b>	<b>SD</b>	<b>t</b>	<b>P</b>
<b>Demonstrate Concept Representationally</b>				
General Educators	1.08	.273		
Special Educators	1.08	.282	(97)= -.052	.96
<b>Demonstrate Concept Concretely</b>				
General Educators	1.08	.273		
Special Educators	1.08	2.82	(97)= -.052	.96

<b>Use Tools Representing All Levels of Learning</b>				
General Educators	1.19	.392		
Special Educators	1.17	.381	(97)=.219	.83
<b>Grouping Practices Aligned</b>	<b>M</b>	<b>SD</b>	<b>t</b>	<b>P</b>
<b>Have Students Work in Same Ability Groups</b>				
General Educators	1.09	.293		
Special Educators	1.13	.344	(96)= -.510	.61
<b>Provide Cooperative Learning Activities</b>				
General Educators	1.08	.273		
Special Educators	1.13	.344	(96)= -.727	.47
<b>Provide Small Group Assistance</b>				
General Educators	1.05	.226		
Special Educators	1.09	.288	(96)= -.583	.56
<b>Provide Peer Tutoring Opportunities</b>				
General Educators	1.15	.356		
Special Educators	1.09	.288	(96)=.733	.47
<b>Self-Monitoring Aligned</b>	<b>M</b>	<b>SD</b>	<b>t</b>	<b>P</b>
<b>Teach Self-Monitoring Strategies</b>				
General Educators	1.45	.501		
Special Educators	1.26	.449	(40.277)=1.749	.09

## Summary

General and special educators' perceptions of preparedness to use instructional strategies were compared within five instructional practices: aligned with NCTM standards, aligned with direct instruction, aligned with graduated instruction, aligned with grouping practices, and aligned with self-monitoring. Concerning preparedness to use instructional strategies consistent with NCTM standards, general and special educators exhibited a statistically significant difference regarding their preparedness to embed math in real world tasks. General and special educators also showed a statistically significant difference in their preparedness to provide advance organizers, a strategy aligned with direct instruction. Both statistically significant differences depicted that special educators had greater perceptions of preparedness to use the strategies.

### Summary of Data Analysis

As part of the survey, general and special educators had the opportunity to self-report based on a series of questions pertaining to their use of instructional practices, as well as their perceptions of preparedness to use the instructional practices. The survey was open for three weeks and was completed by 113 respondents. With an approximate population of 433 general and special educators between the two school districts, a +/- 6.5% sampling error was tolerated.

The criterion variables (aligned with NCTM standards, aligned with direct instruction, aligned with graduated instruction, and aligned with student grouping) were analyzed via Cronbach's coefficient alpha to determine the inter-item consistency reliability of each category. The strategies aligned with NCTM standards ( $\alpha=.638$ ), direct instruction ( $\alpha=.663$ ), graduated instruction ( $\alpha=.686$ ), and grouping practices ( $\alpha=.615$ )

were all moderate in reliability. Internal validity was determined to be sufficient to maintain the criterion variable groupings.

Concerning the first research question, two statistically significant differences were found when comparing general and special educators' use of instructional practices. The strategies 'Encourage Development of Problem Solving', which is aligned with NCTM standards and 'Provide Small Group Instruction', which is aligned with direct instruction both showed statistically significant differences. Concerning the second research question, two additional statistically significant differences were reported when comparing general and special educators. The strategies 'Preparedness to Embed Math in Real World Tasks', aligned with NCTM strategies and 'Preparedness to Provide Advance Organizers', aligned with direct instruction showed statistically significant differences between the two types of educators, with special educators feeling more prepared to use the two strategies. Open-ended questions following each instructional practice were included to determine if the respondent was self-reporting implementation of the instructional practices in the way they were meant to be implemented. For example, following each instructional practice, the statement 'Please provide an example of how you use at least one of these instructional strategies in your classroom' was provided. This was done in an effort to strengthen the instrument's fidelity. An example of a response for each instructional practice is provided in Table 12.

Table 12. Examples of Responses of Use of Instructional Practices

Instructional Practice	Example of Response
Aligned with NCTM Standards	When we are going over the examples, I ask the students how they arrived at their answer. I then ask if anyone did it a different way. We discuss the various ways a problem can be solved, what is the easiest, what would not work and why, what steps have to be present.
Aligned with Direct Instruction	I use scaffolding for new concepts to show the students how things they have learned in the past are utilized for higher level math.
Aligned with Graduated Instruction	When explaining percent of change using the rising gas prices we graph the prices to give us a visual understanding of how the prices have changed over the years.
Aligned with Grouping Practices	I use students who show a mastery or comprehension of material to tutor those who struggle before those students receive help from me. I have a rule “ask three, then me” where the students must ask three peers for help before coming to me.
Aligned with Self-Monitoring	With word problems...by demonstrating techniques for solving and having students share their method...paraphrasing in our own words, drawing pictures, using numbers to replace variables.

Examples gathered from randomized responses showed that the respondents do self-report implementation of the instructional practices accurately.

## CHAPTER FIVE: SUMMARY

### Purpose and Procedures

The purpose of this chapter is to further examine the results of the current research study. First, the chapter begins with a discussion and interpretation of the major findings. Next, limitations will be discussed. Then, implications for practice, recommendations for future research, and a summary will be provided.

### Major Findings

The current study examined general and special educators' use of strategies aligned with instructional practices concerning NCTM standards, direct instruction, graduated instruction, grouping practices, and self-monitoring. Educators' responses reflected research-based instructional practices that have been validated with students with learning disabilities.

When analyzing the demographic data gathered from the survey, statistically significant differences between general and special educators were highlighted in three areas. General and special educators differed greatly in gender, with the majority of educators being female overall. Only females made up the respondents of special educators. The second demographic that showed a statistically significant difference was whether the educator was certified to teach mathematics. General educators had a much greater average than special educators. Finally, the third statistically significant difference was the years teaching students with LD. Special educators had taught students with LD longer than general educators.

In the current study, no statistically significant differences were exhibited when comparing the use of the 22 strategies grouped into the five instructional practices



between the general and special educators. When the instructional practices were divided, however, into the respective strategies, two significant differences were found between general and special educators. Special educators reported greater encouragement for the development of problem solving strategies, as well as providing small group assistance more often. Also, two significant differences were apparent across teacher types with special educators reporting greater preparedness to embed mathematics in real world tasks and providing advanced organizers. Graphic organizers have been effective in mathematical concepts for students with learning disabilities (Ives, 2007). Additional non-significant differences were found in each of the five categories of instructional practices for both use and perceptions of preparedness (See Tables 9 and 11).

Descriptive statistics depicted the following trends:

#### NCTM

A common theme between both general and special educators was the low usage of graphing calculators. Although the use of graphing calculators is an instructional practice recommended by NCTM, less than half of the general educators and one-quarter of the special educators reported using this practice.

#### Direct Instruction

The majority of general and special educators alike reported using technology aligned with Direct Instruction occasionally to daily. However, 35% of general educators reported graphing student progress to make instructional decisions, which aligned with only 65% reporting preparedness to do so.

## Graduated Instruction

The majority of both general and special educators' preparedness to use and reported use of techniques consistent with graduated instruction was relatively equal with special educators feeling slightly more prepared to use tools representative of all levels of learning. The use of graduated instruction has been proven to be effective to teach all levels of math concepts to students with learning disabilities (Maccini & Hughes, 2000; Maccini & Ruhl, 2000; Witzel, Mercer, & Miller, 2003; Witzel, 2001; Witzel, 2005).

## Grouping Practices

One variable related to student grouping showed a statistically significant difference between teacher types, with special educators reporting greater frequency of providing small group assistance. In general, however, general educators reported feeling more prepared to use all grouping techniques except 'providing opportunities for peer tutoring sessions'. Peer tutoring has been proven beneficial for students with learning disabilities (Allsopp, 1997; Calhoon, Fuchs, & Hamlett, 2000).

## Self-Monitoring

Just over half of general educators and nearly three-quarters of special educators felt prepared to teach self-monitoring strategies. Both groups reported low frequencies of using this instructional technique with less than half of the special educators and just over one-quarter of the general educators actually teaching self-monitoring strategies to their students.

Trends in the descriptive data suggest that general educators have greater use of and feel more prepared to use instructional strategies regarding mathematics content (i.e.,

demonstrating use of a graphing calculator and encouraging the practice of basic math skills). Likewise, special educators exhibited greater use of and an increased preparedness to use instructional strategies concerned with pedagogy (i.e., provide small-group assistance while the rest of the class works on assignments and encourage students to develop strategies to solve mathematical problems). Examples gathered from randomized responses of open-ended questions showed that the respondents do self-report implementation of the instructional practices accurately.

Following the questions regarding use of instructional practices and perceptions of preparedness to use the instructional practices, participants were asked what barriers they have encountered that would hinder their implementation of research-based instructional practices. The following are examples of participant responses:

- Teachers need professional development to implement research-based activities.
- Lack of training is often the barrier I see in schools.
- Lack of appropriate professional development and time for teachers to reflect on what is working and what is not working.
- Lack of knowing what is available to use.
- As I struggle to fully implement inquiry based learning, my biggest barrier is lack of experience. I've spent hours reading and studying about it. I've actually put it into practice to the best of my ability. But, I'm still not certain exactly what it looks like. I need to SEE and EXPERIENCE it through observation. Further, I need to collaborate with other teachers to better plan for inquiry learning.
- Lack of time to properly prepare. Lack of GOOD professional development. Lack of funding for appropriate materials. Lack of time to collaborate with other teachers.
- Not enough skill in the area to provide the amount of support needed for some of the math concepts taught at the school.
- Lack of professional development and classroom management strategies.
- I am not familiar with what manipulatives are available and how to use them.
- Lack of professional development/training, lack of mastery of basic skills.
- For math: sometimes lack of materials, lack of professional development that 'shows' how something works (don't just tell me about it), and NOT consistently knowing about all the research-based activities that are out there or are available.

IF I don't read about something, we don't EVER share this kind of information as a department or as a staff at our school. Would be great if we did.

### Limitations

One limitation of this research was the self-reporting of data. Self-reporting negates the ability to verify the use of the instructional practices in the classroom. Due to the small sample size of the special educators, generalizability and standard error of the results is limited. The return rate of special educators remained low due to lack of control over dissemination of information and the instrument itself. Recent research has shown several additional limitations, such as the challenge of getting participants to open email and click on the survey link, due to the amount of Spam individuals get routinely in their emails, as well as attempting to obtain responses during traditionally busy time periods (Pulseware, 2008). Another limitation was the inter-item consistency reliability. Due to the limitation of items within each group of instructional practices, the reliability was moderate. An increase in items, in general, increases the variables' reliability.

### Implications for Practice

The reported findings from this study, based on both statistically and non-statistically significant differences amongst the groups, concur with the research presented by Gagnon and Maccini (2007), that professional development opportunities are imperative to increase educators' content and pedagogical knowledge, thereby increasing the effectiveness of the instruction of mathematics for students with learning disabilities. For example, general educators reported greater use of instructional strategies supported by content knowledge and less use of instructional strategies supported by pedagogical knowledge. Likewise, special educators reported greater use of instructional

strategies supported by pedagogical knowledge and less use of instructional strategies supported by content knowledge. This information affirms the role of the special educator to make accommodations to students with learning disabilities in mathematics. Additionally, the analyses provide information regarding the dispositions of educators regarding how they adapt what they know towards their mathematics instruction.

Based on this and prior research, professional development opportunities in both content and pedagogy are vital. The information gathered both in the statistically and non-statistically significant differences between the educators addressed the need for content and pedagogical professional development for both new and established educators to receive up-to-date, research-based, instructional practices that have been validated for students with learning disabilities.

#### Recommendations for Future Research

The results of the current study indicated differences between general and special educators in their use of instructional practices regarding both, content and pedagogy, as well as their perceptions of preparedness to use the instructional practices. However, the results must be cautiously interpreted due to response rate. For future replications, one aspect of the study that could be done differently is to state to school districts the need to have numerous contacts with the potential participants. Dillman (2007) stresses the need for numerous contact opportunities. Additionally, the study should be replicated with a larger and more demographically diverse sample, accounting for participants from urban, suburban, and rural settings. Also, consider reporting an alternative estimate of reliability, not Cronbach's Coefficient Alpha, to alleviate issues regarding the number of items within each variable. Another recommendation for future research is to have

additional ways to triangulate the data, such as focus groups, interviews, and a Fidelity of Implementation checklist. These analyses may provide additional information for delivery of professional development. Additionally, disaggregating data by alternative predictor variables (certification type, degree earned, years teaching mathematics, etc.) may also provide valuable information for designing professional development. Finally, a recommendation for the instrument, due to the latest approaches according to NCTM, is to adjust the items, reflecting NCTM's Focal Points.

### Summary

Previous research has examined secondary general and special educators' familiarity with content knowledge and practices, teacher preparation, and teacher beliefs and orientation. The current study focused specifically on middle school general and special educators' use of instructional practices and their preparation to use the instructional practices. In contrast to the previous study, the research instrument was provided online and had the potential to reach a greater sample size if projected nationally, as was the prior study.

The results determined the need for professional development that provides current teaching trends aligned with research-based instructional practices. The current study expounds upon prior research showing the importance of providing comprehensive professional development to educators on effective instructional practices in mathematics. Educators must not only have a broad understanding of mathematics content, but also have the pedagogical expertise needed to reach students with learning disabilities. The professional developments must contain research-based instructional practices that focus on conceptual understanding.

Although federal legislation calls for educators to be highly qualified, there is still great discrepancy between research and practice. The reauthorization of the Individuals with Disabilities Education Act (IDEA-R) of 2004 mandates that professional development be provided by states to keep educators updated on current teaching strategies, resources, and technology. The push for using research-based practices must be supported by professional development opportunities that provide educators with inquiry-based methods meeting the learning needs of students with learning disabilities. Professional development must focus on continually preparing educators with the tools and strategies they will need to be highly qualified and provide high quality education for their students.

## **APPENDIX A: ORIGINAL SURVEY USE REQUEST**



**From:** <maccini@umd.edu>

2/18/2008 12:23 PM

**To:** Robertson, Shelby

**Subject:** Re: Mathematics Instructional Practice article`

Hi Shelby, the reliability and validity of the survey is in the article and that is the info I have. I do not mind if you use certain questions and reference me and Joe Gagnon, but not the entire survey. I will check if I have a hard copy to send you; however, I will be out of town this and next week so please remind me in about a week and half or so to mail a copy to you. Thanks, P.Maccini

**From:** "Gagnon,Joseph" <jgagnon@coe.ufl.edu>

3/13/2008 11:57 AM

**To:** Robertson, Shelby

**Subject:** RE: Survey Permission

Hi Shelby,

It looks like, from the email, that she would prefer that you use the questions as they are reported in the publication. The results section has each question and teacher responses. For me to provide more than that, I would need to have her agreement. I don't think, however, if she doesn't think it's a good idea to provide the entire survey that it would prevent you from doing a replication/extension. Any published empirical study should have the necessary information for replication and I believe that is the case for that article.

One other issue that she did mention in the email was that she would be ok if you used some questions, but not all questions. I also think this is a good idea. As you develop your dissertation consider that you could do a replication, but that it is better to extend the research and address some of the unanswered questions that are identified under Future Research. Doing so, would allow you to assert that your study provides a unique contribution to the field.

Given these ideas, let me know if you would still like me to talk with Polly.

Cheers,  
Joe

Joseph C. Gagnon, Ph.D.  
University of Florida  
Department of Special Education  
605 SW 13th Street  
P.O. Box 117050 / G-315 Norman Hall  
Gainesville, FL 32611-7050  
(352) 392-0701 Ext: 245  
Fax: (352) 392-2655  
Email: [jgagnon@coe.ufl.edu](mailto:jgagnon@coe.ufl.edu) <<mailto:jgagnon@coe.ufl.edu>>

## **APPENDIX B: IRB APPROVAL**



University of Central Florida Institutional Review Board  
Office of Research & Commercialization  
12201 Research Parkway, Suite 501  
Orlando, Florida 32826-3246  
Telephone: 407-823-2901, 407-882-2901 or 407-882-2276  
[www.research.ucf.edu/compliance/irb.html](http://www.research.ucf.edu/compliance/irb.html)

### Notice of Expedited Initial Review and Approval

From : UCF Institutional Review Board  
FWA00000351, Exp. 5/07/10, IRB00001138

To : Shelby C Robertson

Date : May 16, 2008

IRB Number: SBE-08-05642

Study Title: Comparing Middle School General and Special Educators' Use of Research-Based Instruction in Mathematics for Students with Learning Disabilities

Dear Researcher:

Your research protocol noted above was approved by expedited review by the UCF IRB Vice-chair on 5/16/2008. The expiration date is 5/15/2009. Your study was determined to be minimal risk for human subjects and expeditable per federal regulations, 45 CFR 46.110. The category for which this study qualifies as expeditable research is as follows:

7. Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

A waiver of documentation of consent has been approved for all subjects. Participants do not have to sign a consent form, but the IRB requires that you give participants a copy of the IRB-approved consent form, letter, information sheet, or statement of voluntary consent at the top of the survey.

All data, which may include signed consent form documents, must be retained in a locked file cabinet for a minimum of three years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained on a password-protected computer if electronic information is used. Additional requirements may be imposed by your funding agency, your department, or other entities. Access to data is limited to authorized individuals listed as key study personnel.

To continue this research beyond the expiration date, a Continuing Review Form must be submitted 2 – 4 weeks prior to the expiration date. Advise the IRB if you receive a subpoena for the release of this information, or if a breach of confidentiality occurs. Also report any unanticipated problems or serious adverse events (within 5 working days). Do not make changes to the protocol methodology or consent form before obtaining IRB approval. Changes can be submitted for IRB review using the Addendum/Modification Request Form. An Addendum/Modification Request Form cannot be used to extend the approval period of a study. All forms may be completed and submitted online at <http://iris.research.ucf.edu>.

Failure to provide a continuing review report could lead to study suspension, a loss of funding and/or publication possibilities, or reporting of noncompliance to sponsors or funding agencies. The IRB maintains the authority under 45 CFR 46.110(e) to observe or have a third party observe the consent process and the research.

On behalf of Tracy Dietz, Ph.D., UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 05/16/2008 01:31:19 PM EDT

IRB Coordinator

**APPENDIX C: DISTRICT-A APPROVAL TO CONDUCT RESEARCH**

Submit this form and a copy of your proposal to: <u>Accountability, Research, and Assessment</u> <u>P.O. Box 271</u> <u>Orlando, FL 32802-0271</u>	<b>Orange County Public Schools</b> <b>RESEARCH REQUEST FORM</b>	Your research proposal should include: <ul style="list-style-type: none"> <li>• Project Title</li> <li>• Purpose and Research Problem</li> <li>• Instruments</li> <li>• Procedures and Proposed Data Analysis</li> </ul>	
Requester's Name <u>Shelby Robertson</u> Address <u>16877 E. Colonial Drive #220, Orlando, FL 32820</u> Institutional Affiliation <u>University of Central Florida</u> Project Director or Advisor <u>Dr. Mary Little</u> Address <u>1673 Mason Avenue, Suite 207, Daytona Beach, FL 32117</u>		Date <u>05/01/08</u> Phone <u>321-246-6550</u> Phone <u>386-274-0175</u>	
Degree Sought: (check one) <input type="checkbox"/> Associate <input checked="" type="checkbox"/> Doctorate <input type="checkbox"/> Bachelor's <input type="checkbox"/> Not Applicable <input type="checkbox"/> Master's <input type="checkbox"/> Specialist			
Project Title: <u>Comparing Middle School General and Special Educators' Use of Research-Based Instruction in Mathematics for Students With Learning Disabilities</u>			
<b>ESTIMATED INVOLVEMENT</b>			
PERSONNEL/CENTERS	NUMBER	AMOUNT OF TIME (DAYS, HOURS, ETC.)	SPECIFY/DESCRIBE GRADES, SCHOOLS, SPECIAL NEEDS, ETC.
Students			
Teachers	Middle-Math		Middle school general and special educators that teach mathematics
Administrators			
Schools/Centers			
Others (specify)			
Specify possible benefits to students/school system: <u>Findings will contribute to the research regarding general and special educators' preparation, knowledge, and use of research-based practices in their middle school classrooms. The school system will be able to identify areas of need for potential professional development.</u>			
<b>ASSURANCE</b>			
Using the proposed procedures and instrument, I hereby agree to conduct research in accordance with the policies of the Orange County Public Schools. Deviations from the approved procedures shall be cleared through the Senior Director of Accountability, Research, and Assessment. Reports and materials shall be supplied as specified.			
Requester's Signature <u>Shelby Robertson</u>		RECEIVED MAY 02 2008	
Approval Granted: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No             Date: <u>5-2-08</u>			
Signature of the Senior Director for Accountability, Research, and Assessment		<u>Lee Balan</u>	

University of Central Florida 100  
 LIC# 120000000000000000000000  
 THE APPROVAL DATE: 5/2/2008  
 THE APPLICATION NUMBER: 05/01/08

**APPENDIX D: DISTRICT-B APPROVAL TO CONDUCT RESEARCH**



SEMINOLE COUNTY  
PUBLIC SCHOOLS

WILLIAM VOGEL, Ed.D.  
*Superintendent*

Educational Support Center  
400 E. Lake Mary Boulevard  
Sanford, Florida 32773-7127

RONALD L. PINNELL, Ed.D.  
*Executive Director of  
Secondary Education*

WALT GRIFFIN  
*Executive Director of  
Secondary Education*

Telephone: (407) 320-0039  
Facsimile: (407) 320-0293  
Suncom: 351-0038

Visit Our Web Site  
[www.scpa.k12.fl.us](http://www.scpa.k12.fl.us)

May 12, 2008

Ms. Shelby Robertson  
University of Central Florida  
1673 Mason Ave., Suite 207  
Daytona Beach, FL 32117

Dear Ms. Robertson:

I am in receipt of the proposal and supplemental information that you submitted for permission to conduct research in the Seminole County Public Schools. After review of these documents, it has been determined that you are granted permission with the following limitation - no use of the Seminole County Public Schools' email system to conduct the study described in these documents.

Each school principal has the authority to decide if he/she wishes to participate in your study or if it is appropriate to release any requested information. Therefore, your first order of business is to contact the principals of the middle schools that you wish to involve in your research to explain your project and seek permission to conduct the research at that particular school. To assist you in contacting the schools I have attached a SCPS school address list with the principals' names highlighted. If necessary you are expected to make appointments in advance to accommodate the administration and/or staff for research time.

Please forward a summary of your project to my office upon completion.  
Good Luck!

Sincerely,

Ronald L. Pinnell, Ed.D.  
Executive Director  
Secondary Education

RP/jr

## **APPENDIX E: INFORMED CONSENT**





### *Informed Consent*

Researchers at the University of Central Florida (UCF) study many topics. To do this we need the help of people who agree to take part in a research study. You are being invited to take part in a research study which will include about 400 people. You can ask questions about the research. You can read this form and agree to take part right now, or take the form home with you to study before you decide. You will be told if any new information is learned which may affect your willingness to continue taking part in this study. You have been asked to take part in this research study because you are a middle school general or special educator that teaches mathematics. You must be 18 years of age or older to be included in the research study.

The person doing this research is Shelby Robertson, a doctoral student at the University of Central Florida, College of Education. Because the researcher is a doctoral student, she is being guided by Dr. Mary Little, a UCF faculty supervisor in the College of Education.

**Study title:** Comparing Middle School General and Special Educators' Use of Research-Based Instruction in Mathematics for Students with Learning Disabilities

**Purpose of the research study:** The purpose of this study is to compare the instructional practices of general and special educators in mathematics.

**What you will be asked to do in the study:** To participate in this study, you will be asked to take one online survey.


**Voluntary participation:** You should take part in this study only because you want to. There is no penalty for not taking part, and you will not lose any benefits. You have the right to stop at any time. Going to the website and completing the survey will constitute your informed anonymous consent.

**Location:** The hyperlink to access the online survey is (Insert URL here), which will be available for a two-week time period. Please complete the survey by Sunday, June 1.

**Time required:** The time necessary to complete the online survey is approximately 15 minutes. Nothing additional is required to participate.

**Risks:** There are no anticipated risks in this study, however, every effort has been made to protect your identity. To support this, your employer will only receive anonymous grouped data in aggregate form. You do not have to answer any question that you do not wish to answer.

**Benefits:** There are no expected benefits to you directly for taking part in this study. As a research participant you will not benefit directly from this research, besides learning more about how research is conducted. The benefit to the educational community overall

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is the investigation of teachers' perceptions regarding their preparedness to use and knowledge of instructional practices. This information will assist in the organization of professional development for both pedagogy and content in the area of mathematics.

**Compensation or payment:** The compensation for you taking part in this study is a set of Math Dice, "The Fast Fun Game of Mental Math." After completing the online survey, please contact your mathematics curriculum specialist (MCS) who will have the researcher provide him/her with the item. The MCS will only provide the research with a total amount of items needed for your district. Your identity will remain anonymous.

**Anonymous research:** This study is anonymous. That means that no one, not even members of the research team, will know that the information you gave came from you.

**Study contact for questions about the study or to report a problem:** Shelby Robertson, Doctoral Student, Exceptional Education Program College of Education, 407-823-2598 or by email at [scrobert@mail.ucf.edu](mailto:scrobert@mail.ucf.edu) (or) Dr. Mary Little, Faculty Supervisor, Department of Education at (407) 823-2275 or by email at [mlittle@mail.ucf.edu](mailto:mlittle@mail.ucf.edu).

**IRB contact about your rights in the study or to report a complaint:** Research at the University of Central Florida involving human participants is carried out under the oversight of the Institutional Review Board (UCF IRB). For information about the rights of people who take part in research, please contact: Institutional Review Board, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901.



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## **APPENDIX F: REVISED SURVEY**

# Research-Based Instructional Strategies in Mathematics Survey

## 1. Research-Based Instructional Strategies in Mathematics Survey

Thank you for taking your time to complete this survey. Please answer the following questions knowing that your identity is confidential. Again, your participation in this study is greatly appreciated.

## 2. Open-Ended Questions

Please provide answers to the following open-ended questions.

### 1. Please define what math means to you.

### 2. Please tell us what you know about Direct Instruction

### 3. Please tell us what you know about graduated instruction

### 4. Please tell us what you know about student grouping

### 5. Please tell us what you know about self-monitoring

### 6. From where did you acquire knowledge of the instructional practices that you use in your classroom (e.g., college courses, professional development in your school, other teachers, etc.)?

Please include all professional development that you have attended in the last five years.

## 3. Teacher Demographics and Characteristics

Please answer the following questions based on personal demographics and characteristics:

### 7. Gender

Male

Female



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## Research-Based Instructional Strategies in Mathematics Survey

### 8. Ethnicity

- African American
- American Indian
- Pacific Islander
- Hispanic
- White/Caucasian
- Multiracial

Other (please specify)

### 9. Highest Education Completed

- Bachelor's Degree
- Master's Degree
- Specialist Degree
- Doctoral Degree

### 10. Are you a general educator or a special educator?

- General Educator
- Special Educator

### 11. Do you hold mathematics teaching certification?

- Yes
- No

### 12. How did you achieve your certification in teaching?

- 4 year college or university
- Alternative certification course
- Took a certification test

Other (please specify)

### 13. How many general education mathematics methods courses have you taken?

- None
- 1-2
- 3 or more



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## Research-Based Instructional Strategies in Mathematics Survey

### 14. How many years have you taught mathematics?

- 1-3
- 4-6
- 7-9
- 10 or more

### 15. How many years have you taught students with learning disabilities?

- 1-3
- 4-6
- 7-9
- 10 or more

## 4. School Demographics and Characteristics

Please answer the following questions based on the demographics and characteristics of your school:

### 16. How many students are currently attending the school in which you are employed?

- Less than 500
- 501-750
- 751-1000
- More than 1000

### 17. Describe the school's location.

- Urban
- Suburban
- Rural

### 18. What is your teaching assignment?

Check all that apply

- General education classroom
- Team/Co-teaching classroom
- Resource room
- Self-contained
- Math lab



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## Research-Based Instructional Strategies in Mathematics Survey

**19. Approximately how many students in your class have diagnosed learning disabilities?**

- 1-5
- 6-10
- More than 10

**20. What is the average number of students in a typical class?**

- Less than 15
- 16-20
- 21-25
- 26-30
- More than 30

### 5. Use of Instructional Strategies

Please answer the following questions based on the use of instructional practices in your classroom:

**21. Are you aware of the National Council of Teachers of Mathematics (NCTM) standards?**

- Yes
- No

**22. Do you refer to the NCTM standards when planning mathematics instruction?**

- Never
- Seldom
- Occasionally
- Always
- Not Sure



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## Research-Based Instructional Strategies in Mathematics Survey

**23. Please report on the frequency that you use the following instructional techniques in your classroom:**

	Never	Seldom	Occasionally	Daily
Do you encourage students to develop strategies to solve mathematics problems?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you demonstrate use of a graphing calculator?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you embed math in real-world tasks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you encourage student discussions of approaches to problem solving?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you illustrate a concept via multiple models?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please provide an example of how you use at least one of these instructional strategies in your classroom:



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## Research-Based Instructional Strategies in Mathematics Survey

**24. Please report on the frequency that you use the following instructional techniques in your classroom:**

	Never	Seldom	Occasionally	Daily
Do you provide teacher modeling of a concept, skill, or strategy?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you provide feedback and reinforcement to students?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you incorporate mastery learning/criterion before having students advance to the next topic/skill?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you provide a review of previously learned skills/concepts?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you provide independent practice?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you provide cumulative reviews?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you graph student progress to make instructional decisions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you give regular orientation or advance organizers for a new lesson?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you encourage the practice of basic math skills?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please provide an example of how you use at least one of these instructional strategies in your classroom:



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## Research-Based Instructional Strategies in Mathematics Survey

**25. Please report on the frequency that you use the following instructional techniques in your classroom:**

	Never	Seldom	Occasionally	Daily
Do you demonstrate a concept representationally using graphs, charts, etc?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you demonstrate a concept concretely using manipulatives?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you use tools representing all levels of learning (i.e., concrete, representation, and abstract)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please provide an example of how you use at least one of these instructional strategies in your classroom:

**26. Please report on the frequency that you use the following instructional techniques in your classroom:**

	Never	Seldom	Occasionally	Daily
Do you have students work in same-ability groups?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you provide cooperative learning activities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you provide small-group assistance while the rest of the class works on assignments?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do you provide opportunities for peer tutoring sessions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please provide an example of how you use at least one of these instructional strategies in your classroom:



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## Research-Based Instructional Strategies in Mathematics Survey

**27. Please report on the frequency that you use the following instructional techniques in your classroom:**

	Never	Seldom	Occasionally	Daily
Do you teach self-monitoring strategies to help students with problem-solving activities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please provide an example of how you use this instructional strategy in your classroom:

**28. Do you teach using metacognitive strategies (e.g., paraphrasing, visualizing, etc) to help students with problem solving? Please explain.**

### 6. Preparedness for the Use of Instructional Strategies

Please answer the following questions based on how prepared you feel to use the following instructional practices:




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## Research-Based Instructional Strategies in Mathematics Survey

### 29. I feel that I am prepared/unprepared to use the following instructional practices in my classroom:

	Prepared	Unprepared
Encourage students to develop strategies to solve mathematics problems	<input type="checkbox"/>	<input type="checkbox"/>
Demonstrate the use of a graphing calculator	<input type="checkbox"/>	<input type="checkbox"/>
Embed math in real-world tasks	<input type="checkbox"/>	<input type="checkbox"/>
Encourage student discussion of approaches to problem solving	<input type="checkbox"/>	<input type="checkbox"/>
Illustrate a concept via multiple models	<input type="checkbox"/>	<input type="checkbox"/>
Provide teacher modeling of a concept, skill, or strategy	<input type="checkbox"/>	<input type="checkbox"/>
Provide feedback and reinforcement to students	<input type="checkbox"/>	<input type="checkbox"/>
Incorporate mastery learning/criterion before having students advance to the next topic/skill	<input type="checkbox"/>	<input type="checkbox"/>
Provide a review of previously learned skills/concepts	<input type="checkbox"/>	<input type="checkbox"/>
Provide independent practice	<input type="checkbox"/>	<input type="checkbox"/>
Provide cumulative reviews	<input type="checkbox"/>	<input type="checkbox"/>
Graph student progress to make instructional decisions	<input type="checkbox"/>	<input type="checkbox"/>
Give regular orientation or advance organizers for a new lesson	<input type="checkbox"/>	<input type="checkbox"/>
Encourage the practice of basic math skills	<input type="checkbox"/>	<input type="checkbox"/>
Demonstrate a concept representationally using graphs, charts, etc	<input type="checkbox"/>	<input type="checkbox"/>
Demonstrate a concept concretely using manipulatives	<input type="checkbox"/>	<input type="checkbox"/>
Use tools representing all levels of learning (i.e., concrete, representation, and abstract)	<input type="checkbox"/>	<input type="checkbox"/>
Have students work in same-ability groups	<input type="checkbox"/>	<input type="checkbox"/>
Provide cooperative learning activities	<input type="checkbox"/>	<input type="checkbox"/>
Provide small-group assistance while the rest of the class works on assignments	<input type="checkbox"/>	<input type="checkbox"/>
Provide opportunities for peer tutoring sessions	<input type="checkbox"/>	<input type="checkbox"/>
Teach self-monitoring strategies to help	<input type="checkbox"/>	<input type="checkbox"/>


**University of Central Florida IRB**  
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## Research-Based Instructional Strategies in Mathematics Survey

students with problem-solving activities

### 7. Barriers of Implementation

Please provide an answer to the following open-ended question.

**30. What barriers have you encountered that would hinder the implementation of research-based activities in your classroom (e.g., lack of administrative support, lack of materials, lack of professional development, etc)?**



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## LIST OF REFERENCES

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