THE EFFECTS OF VISUAL STIMULATION ON THE MATHEMATICS PERFORMANCE OF CHILDREN IN SECOND GRADE WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD)

by

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CERTIFICATION OF PROJECT WORK

We, the undersigned, certify that this project entitled
THE EFFECTS ON STUDENTS WITH LEARNING DISIBILITIES IN A SECOND GRADE MATH CLASSROOM WITH THE USE OF MANIPULATIVES.

By Alicia K. Britt, Candidate for the Degree of Master of Science in Education,
[Curriculum & Instruction is acceptable in form and content and demonstrates a satisfactory knowledge of the field covered by this project.

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Abstract

Students in Elementary schools may learn differently than older students. Manipulatives used in the Second grade classroom can benefit student learning. Students of all learning abilities can benefit from the use of manipulatives in the classroom. All students in elementary schools can learn differently and the way they are taught can help them in their education. Educators should use the best way of instruction to benefit their students. This study looks at the effects on student learning with the use of manipulatives in a second grade classroom. The students are of different levels of learning abilities.

Table of Contents

Introduction

Research indicates that there is a reciprocal relationship between challenging behavior and poor academic performance (Alter, 2008, Barnard-Brak, 2011). Students could then fall into a cycle that affects their education. The negative cycle often takes the form of students being confronted by work that surpasses their academic abilities, responding with challenging behavior, being removed from class and falling even farther behind academically. Barnard-Brak conducted a study on the coexisting disorders and academic achievement among children with ADHD. The goal of Mathematical competence is not being met reached in the United States. How can elementary school teachers help at risk students during math lessons? What strategies can build and improve students learning in a subject that is not being met nationwide? According to Smith, (2011) building mathematical fluency is a key step. Building students' mathematical fluency can increase students' motivation and effort. Smith commented:

> "Results indicated methods such as precision teaching could increase accuracy and fluency and that skip counting methods such as counting by 5s, 6s, and 8s can also be used to increase accuracy and fluency." "Fluency of basic facts is essential to master higher-order skills, such as multi-step problems in algebra and calculus." (Smith, p. 249)

Students are falling behind, leaving many students at risk in the math classroom, especially students with ADHD. Students are then met with challenging behaviors and struggling in the math classroom. When there are students struggling in the classroom it affects the whole class. When a student with ADHD is struggling that is when they may start with extra behavior

problems. Then the students fall behind academically. “Unfortunately, the goal of mathematical competence is not being reached in the United States. In 2009, the National Assessment of Educational Progress (NAEP) reported fewer than 30% of students in grades 8 and 12 achieved proficiency in mathematics,” (Smith, 2001, p. 247). Students need to build the fluency in the early grades so they will be able to achieve higher schools later on in school.

When students spend time on academic tasks, their on-task behavior is incompatible with challenging behaviors and reduces the likelihood of negative outcomes (Alter, 2008). Alter noted: “The effectiveness academic remediation can have on the cycle of academic difficulty leading to challenging behavior leading back to academic difficulty” (p.2). Teachers will need to understand and find out what strategies will effectively help at risk students. Elementary school teachers need to implement academic strategies to meet the needs of students with or at risk for an emotional and behavioral disorder (Alter). The Smith article stated that a few programs can help teachers build students fluency. The programs were published mathematics fluency-building programs. Wong and Evans (2007) used two programs to increase mathematics fluency including Back to Basics Math Multiplication (Back to Basics, 1999) and Mathematics Worksheet Factory Lite (Schoolhouse Technologies, 2001).

Alter (2008) also questioned if there is too much attention on reading interventions rather than mathematics in the classrooms. Are students not receiving enough mathematical interventions for them to comprehend the strategies? Does this further affect at risk students? Alter also questioned whether at risk/students with ADHD are spending too much time in resource rooms. Maybe too much time out of the general education classroom affects the students’ ability to learn in that setting.

Students with ADHD need more stimulation to remain engaged with repetitive tasks (Bennett, 2006). Bennett stated that, "Although it is possible to debate the relative importance of rote skills, it has been demonstrated that rapid fact retrieval is (a) the only significant predictor of math problem solving from among reading comprehension, IQ, and behavioral scores (Zentall, 1990); and (b) the single strongest predictor of reading recognition achievement" (Bennett, p. 189). Students with ADHD appear to have difficulty maintaining attention to repetition, the outcome of which is failure to automatize rote tasks. In the absence of optimally stimulating tasks or setting conditions, such students are more likely to demonstrate sensation-seeking verbal and motor activity, attend to novel stimulation in their internal and external environments (engage in selective attention to salient cues and subsequently demonstrate poor sustained attention), and have difficulty delaying active responses.

Many studies talk about what strategies they have used to increase the abilities of students with ADHD in elementary mathematical classrooms. Strategies from problem solving interventions to computer strategies to word problems help. Bennett (2006) used computer presented math tasks. Students with ADHD perform poorly on math tasks – completing fewer problems at slower speeds and with more errors and also a greater variability than their peers.

The scholarship also referenced several strategies used by others. Smith (2011) studied the importance of building mathematical fluency. Codding commented; "A paucity of published studies on interventions enhancing computational fluency has been conducted" (Codding et al., cited in Smith 2011, p. 248). Teachers should not want the students to rely on time consuming strategies such as finger counting. It is important for students who are at risk or students with ADHD to receive help and be able to use strategies that will increase their mathematical fluency. The Smith study compared the effects of copy-cover-compare (CCC) and goal setting to increase

mathematics fluency with 173 third-grade students. These strategies were used by teaching students to use copy-cover-compare to decrease errors and setting goals to increase fluency. Smith commented: "Results showed the combined CCC and goal setting strategy produced higher scores of computational fluency" (p. 249). Brady (2010) also did a study on the importance of mathematical fluency. This research study was done on multiplication fact fluency for students with ADHD. Fluency in all levels of learning is important in elementary classrooms. The Brady article results show that even with the amount of practice time being equal, 1 minute in both conditions, on average participants practiced 30% more problems with the endurance building practice trials procedure than they did with the whole time practice trial procedure.

DuPaul's (2006) research believed in individual academic achievement for the students. Each student that is at risk in the classroom should be taught strategies that will help them improve their math scores. Each student is an individual that learns in different abilities. Teachers should find what strategies work with the abilities of their students. I intend to study how students learn with visuals and manipulatives in a 2nd grade mathematics classroom. I want to study the effects on the students that have ADHD or are at risk in falling. I believe that students learn better through visual learning.

I have had placements in elementary classrooms or have been a substitute teacher in the classroom and have noticed young students struggling with mathematical strategies. I believe that all students work at different abilities and learn from different strategies. It is great when teachers can figure out what strategies will work for each range of children in their classroom.

I want to work on this study to get a better understanding on how students learn during a mathematics lesson. I want to focus on students that may be struggling. As a teacher I want all

students to do the best they can. I want them to be able to get the most out of their education. It is better for teachers to understand how and what affects their students learning. This study will take place in a second grade classroom. All students in the class will be observed during the study. The students' have a range in academic abilities. The students will be observed during a mathematics lesson taught using visuals and manipulatives and observed and scored. Then the students will have a follow up lesson without visuals or manipulates. The results will be compared and reviewed.

The main purpose of my project is to investigate what strategies effectively improve students' mathematical abilities when they may be at risk or have ADHD. I want to find out how to improve students' math scores in the elementary classroom. I observed the students during the lessons to see what strategies were more effective in passing on knowledge. The students may have challenging behaviors but deserve to be taught how to complete mathematical assignments with strategies that will benefit them stress free.

The research questions that drive this project thus are:

- What mathematical strategies work well in an elementary school classroom with students with ADHD and at –risk students? How can they affect the students?
- Do visuals and manipulatives effect mathematical learning in students with ADHD in the elementary school classroom?

Literature Review

With growing research in education, research should be done so students with Attention Deficit Hyperactivity Disorder (ADHD) or are at risk of failure can improve their academic scores. The students will be shown mathematical methods of instruction to increase their academic growth at the elementary level. According to Bryant (2011), teachers should know how to teach math to at risk students rather than have an extensive background in mathematics. Teachers should be able to benefit their students with different mathematical methods of instruction and strategies to improve their academic growth. This literature review identifies what instructional methods possibly benefit students' needs in the mathematical class room and seeks to provide an answer to the research question, what is the effect of various types of mathematics instructional methods on the academic growth of at risk elementary students? This review also questions if visuals and hands-on materials benefit student learning.

In this area of research the intent of the researchers is to use these strategies to attempt to increase academic growth in students' that are at-risk or have Attention Deficit Hyperactivity Disorder in the Mathematics classroom. Woodward (2006) used timed practice drills to improve students' with developing automaticity with multiplication facts. Other researchers, focused on word problem solving abilities (Alter, P., Brown, E. T., & Pyle, J., 2011; Wheeler, L. J., & McNutt, G., 1983). Academic professionals who are interested in improving students' scores in mathematics, specifically those interested in the question of academic strategies, will benefit from this review.

There are many strategies that can affect students learning. In the mathematics classroom researchers have studied methods that help students with learning with syntactic complexity. In a

study by Wheeler and McNutt (1983), they attempted to determine the influence of syntax on the difficulty of written mathematical problems with low-achieving students. The students were in remedial mathematics classes and received instruction in the application of general mathematical concepts. They stated that, "The students' performance in mathematics was at two or more grade levels below their grade placement" and the students were assessed on three different instruments (p. 310). The methods were designed to measure the syntactic complexity, or difficulty of written mathematical problems at easy syntax test (EST), moderate syntax test (MST) and hard syntax test (HST). The math problems on the tests were from a fourth grade level book and the students took the test with the problems "arranged according to degree of difficulty" (p. 311). The groups of students were given the tests in varying sequence. One group was administrated the EST first, another MST first, and the last HST first. To determine the results of the tests, the mean score of how many problems the students missed was computed. The findings show that although the "mean scores of the EST and the MST are similar, there appears to be a difference between these two and the HST" (p. 313). Therefore, the findings of this study conclude that syntactic complexity affects low-achieving eighth-grade students' abilities to solve mathematical word problems. The researchers believe that if the "vocabulary and computational levels are near the students' capabilities; simple or even moderately difficult syntax does not affect their problem-solving abilities" (p. 314). These researchers have recorded findings that show syntactic complexity affects low achieving students abilities in learning mathematics.

Low achieving students may have trouble learning through problem solving achievement. In another study, by Montague and Applegate (1993) the purpose was to compare mathematical problem solving of students with representing three levels of problem solving ability. The

participants in the study were either learning disabled (LD), average-achieving, or gifted. There were 90 students that participated in the study from various middle schools in the Miami area. The researchers believed that this study would show that "the students with learning disabilities would differ significantly from average-achieving and gifted students in general mathematical achievement as measured by the mathematical subtests of the Woodcock-Johnson Psycho-Educational Battery (WJPB)" (p. 177). The method of the study had the participants screened first to see if the participants met the IQ requirements and the students were then the subject selection criteria permitted the researchers to circumscribe groups of poor, average, and good problem solvers" (p. 178). There were different parts of the tests that the participants took. They were read the problems a loud and were told to show all work to complete the problems. The participant's score were from the WJPB Mathematics Tests, Reasoning Test, and Total Word Problem Score. An interesting thing about the analysis indicated that the "reasoning score test was one of the best predictors of performance on both mathematical problem-solving measures for the gifted group and for the word problem score for the students with LD" (p. 186). Also, the researchers found that no group differences were found for the reasoning measure, which is consistent with findings in previous study that did not correct for IQ variability of the ability groups (Montague & Bos, 1990). The researchers believe that "without explicit instruction in cognitive and metacognitive strategies necessary for solving mathematical word problems, it is doubtful that students with learning disabilities will learn to apply acquired mathematical skills and knowledge" (p. 193). Students with learning disabilities may need to get the extra help in the math classroom to be able to understand the math skills needed to solve mathematical word problems.

Students with disabilities may learn from schema-based and using basal strategies. In another study, by Jitendra, Griffin, McGoey, Gardell, Bhat, & Riley (1998) the researchers studied the effects of mathematical word problem solving by students at risk or with mild disabilities. The researchers conducted the study based on the effects of 2 instructional strategies, "an explicit schema-based strategy and a traditional basal strategy" (p. 345). The participants in the study were 34 elementary students from grades 2-5. Twenty-five of the students were classified as having mild disabilities and "the remaining 9 students included low-performing (at-risk) students who were not classified as being disabled but were experiencing difficulty in mathematics" (p. 347). There were 2 phases to the study, the first phase was where "differential effects of a schema strategy and a traditional basal strategy were on the acquisition of simple one-step word problems were assessed" (p. 349). The second phase was where maintenance and generalization of the two instructional strategies were examined. Looking at the qualitative data the study had some encouraging results. The results indicated that when elementary students with learning problems were taught to use a "schema strategy to solve mathematical word problems, their performance on measure of acquisition, maintenance, and generalization was better than that of students who received instruction that typified the basal textbook" (p. 353). Schema-based problem-solving instruction represents a response to changes in the way we think about instruction for students with disabilities, said the researchers. After the research by Jitendra, et. al it concludes that future examination deserves to be investigated.

Looking at how students complete independent seatwork with math sheets during independent time can help teachers see how students perform. In a study, Rock (2005) investigated the effects of a strategic self-monitoring intervention on the academic engagement, nontargeted problem behavior, productivity, and accuracy of students with and without

disabilities. There were 9 participants in the study. Of the 9 students that participated in the study 2 were female and 7 were male they were in grades 2-5. All the students were in fully inclusive classrooms. The research was conducted when students were engaged in independent seatwork. Each participant used a "graphic organizer, a timing device, a self-monitoring think sheet" or a self-monitoring booklet, pencil, instructional materials specific to independent seatwork for their materials (p.6). Rock stated: "The ACT-REACT strategy used in this study included a variety of specific components to improve students' academic engagement and productivity" (p. 16). Each of the participants had academic performance goal statements prompts in their self-monitoring booklets. Math productivity and accuracy data was also collected for the participants during the study. During data collection, "the observer was seated on a stool or in a chair in the back of the classroom" (p. 7). The participants worked on Accelerated Math seatwork. After the participants completed an assignment the next math printout included new material that the student had not encountered previously. The participants were then expected to raise their hands and ask for help. The quantitative data from the study concludes that the participants increased math ability with the academic engagement. In conclusion to this study the strategy that was the most pertinent was self-monitoring. (p. 4). Also, a study that incorporates a gradual fading schedule is preferred. Another important consideration is that the complexity of the strategic self-monitoring intervention may not have been necessary, as per the researchers.

Teachers can help students struggling in math with certain multiplication strategies or instruction to get the students learning. Woodward (2006) conducted a study that also involved mathematical strategies to help elementary age students compute multiplication facts using integrated strategy instruction with timed practice drills. The researchers suggest that, "at least two common approaches to developing automaticity in facts. One is grounded in the use of

strategies for teaching facts; the other emphasizes the use of timed practice drills" (p.269). This study was designed to examine the impact of an integrated approach to teaching multiplication facts to fourth-grade students with and without LD. The participants in the study were 58 fourth-grade students from the same elementary school in a Pacific Northwest suburban area. Of the 58 participants 15 were special education students with a range of disabilities. Woodward looked at the integrated approach for his main idea of study. The participants were either in the intervention group or the comparison group. There were also 8 students in the intervention group that had an IEP for math and 7 students in the comparison group with IEPs. During research, "students in the intervention group were taught fact strategies" (p. 272). They were taught to compute 6x7 by 6x6 +6. Students in both groups were taught for 25 minutes per day, five days a week, for four consecutive weeks. Woodward believed that teaching math facts through strategies is beneficial for elementary students. "Researchers made every effort to control the amount of instructional time for each group so that it was the same each day," which was important in the research (p. 274). For the results of the study both groups of participants increased their scores. Researchers found that "posttest mean scores for both groups rose to virtually identical levels at 25.76 and 25.46" (p. 281). Both methods were effective for the participants in raising the mean performance level on math facts to mastery or near mastery levels. Results from this study indicate that an "integrated approach and timed practice drills are comparable in their effectiveness at helping students move toward automaticity in basic facts" (p. 287). Teaching math facts to students that struggle with multiplication can benefit their learning.

There are ways to teach struggling students in math to help grow their working memory and problem solving abilities. Another study about cognitive growth is a study by Swanson, Jerman, & Zheng, (2008). The researchers studied growth in working memory and mathematical

problem solving in children at risk and not at risk for serious math difficulties. According to the researchers "there is evidence that suggests the need for more general cognitive processes, that is, processes nonspecific to mathematics" (Swanson, Jerman, & Zheng, p. 343). Students solve word problems that involve the development of a variety of mental activities. When students solve problems they access pre-stored information. According to the researchers in the study, "we assessed whether the retrievability of contents in long term memory such as math skills, as well as domain-specific knowledge of the propositions found in word problems, mediates working memory and problem solving" (p. 344). The study lasted 3 years and each year there were a different number of participants. The first year (wave) consisted of 353 students, the second year 320 and the third year 302 students. In the first year "134 children (68 boys, 66 girls) were classified at risk for serious math problem solving difficulties (SMD), and 219 children (99 boys and 120 girls) were not at risk" (p. 346). Five doctoral-level graduate students trained in test administration tested all participants in their schools for each group. For each group "one session of approximately 45–60 min was required for small group test administration and one session of 45–60 min for individual administration for each wave" (p. 351). The results were organized into five parts. First, the researchers determined whether the memory tasks fit a three-factor model. Second, they compared performance of children at risk and not at risk for SMD across the testing waves. Third, they tested for convergence across the three age cohorts. Fourth, after factor invariance was tested across the latent measures, a growth curve analysis was conducted using hierarchical linear modeling. The final section of the results focused on Wave 1 predictions of Wave 3 word problem solving. A question from the results from the researchers was "whether performance of children at risk for SMD varied from children not at risk on latent measures across testing waves" (p. 356). The researchers concluded that a test of simple effects indicated

that comparisons between at-risk and not-at-risk students were significant for each wave and domain.

Peer tutoring can be very beneficial to both groups of students. Researchers have studied the effects of peer tutoring as an intervention. Menesses and Gresham (2009) conducted a different study to help at risk students in Mathematics. The researchers study directly compared the academic gains of reciprocal peer tutoring, nonreciprocal peer tutoring, and a waiting-list control group. According to the researchers, "a substantial advantage of peer tutoring is the decreased amount of teacher responsibility in implementing an intervention" (Mesesses & Gresham, p. 266). Peer tutoring can be an efficient method for providing individualized instruction to many students simultaneously. Students could improve their classroom behavior and relationships with their peers with peer tutoring. The participants in the study were 59 elementary students from second-, third-, and fourth-grade classrooms who performed below average on curriculum-based measurement (CBM) math probes. Students assigned to the tutoring conditions "participated in an average of three tutoring sessions per week until they reached the session requirement of 15 sessions total" (p. 269). CBM probes were used to measure each participant's fluency level in mathematics by scoring the number of digits correctly produced within two minutes. The students that were the tutors were individually trained by the primary investigator using a "tell," "show," "do," according to the researchers. Tutors were also trained to measure independent performance of the tutees in a progress monitoring session that took place immediately after each practice session. As for the results the reciprocal, tutee, and tutor groups all showed significant increases in their academic scores, the control group did not. According to Menesses and Gresham, "it is important to note that control students only received conventional teacher-led instruction, which did not focus on the math

facts they had not previously acquired" (p. 272). In conclusion, "when considering the capability of peer tutoring in remediating at-risk students with other at-risk peers as math tutors, the results indicate an efficacious intervention" (p. 273). The study showed that all students involved with peer tutoring increased their academic scores.

During the school year teachers should monitor their students to determine where they may be having a difficult time. In a more recent study by Bryant, Bryant, Roberts, & Vaughn, (2011), the researchers also looked at progress monitoring as an important factor in Mathematical strategies in Elementary Students. The purpose of this study was to "determine the effects of an early numeracy preventative Tier 2 intervention on the mathematics performance of first-grade students with mathematics difficulties" (p. 7). The researchers believed that students did not have sufficient daily time to practice the fundamental numeracy concepts to show significant findings on the fluency measures. The participants in the study were 238 first-grade students that were identified as being at risk. Several students moved away during the school year so at the end there were 65 students in the comparison group and 139 in the treatment group. The participants went through a screening and progress monitoring process, which also included four group administered sub-tests. For the research team, "the project and assessment coordinators conducted a half-day training session" (p. 12). There were 11 units of instruction and each unit had eight days of lessons. The results showed that there were no significant differences found between the two groups. When the data showed slight differences, it was not very statistically significant. In conclusion, "this study sought to determine whether an intervention provided in first-grade to students demonstrating overall low early numeracy and computation performance would be associated with improved outcomes, compared with students randomized to a comparison condition" (p. 17). The findings show that the participants

‘outperformed comparison students by .5 of a standard deviation on three of the four subtests” (p. 18). Overall, by the end of first-grade, 45 % of treatment students and 22% of comparison students were no longer at risk for mathematics difficulties. In summary of the study, “the findings indicate that students who participated in the intervention compared to students from the same classes and schools who did not participate, performed statistically significantly better on the progress-monitoring measure closely aligned with the intervention and the progress monitoring distal measure” (p. 20). This study concluded that the students in the intervention increased their academic scores.

Students with special needs may need extra help in solving mathematical word problems. In the most recent study found, Alter, Brown, & Pyle (2011), also studied the idea of improving mathematical word problem strategies for students with needs. The intervention consisted of an “empirically-based teaching strategy that focused on conceptual understanding, fluency and problem solving delivered by the classroom teacher who had received training via teacher workshops” (p. 535). There were five students in the class and all were identified as having emotional and behavioral disorder (EBD). Three students participated in the study with consent from their families. The procedures took place in the classroom. For the “baseline phase, students worked at their desks on the mathematics problem-solving worksheets” (p. 537). In the intervention phase they received instruction at the teacher’s table and then completed the worksheets while seated at their desks. The participants completed math word problems. The problems were written to “give students a familiar context through use of the classroom names, teachers, principal and situations common for students in the intervention” (p. 539). The study involved three phases; the first phase was the baseline where students completed the worksheets of five mathematical word problems with at least 15 minutes of instruction provided by the

teacher. The second phase was a "teacher training phase in which the classroom teacher attended a workshop to learn how to implement teaching strategies to guide students to use when solving mathematics word problems" (p. 541). The third phase of the study was intervention phase where the teacher used mathematical instruction. The design of the study was "A concurrent multiple-baseline design across students was used to evaluate the impact of this teacher-implemented mathematics problem-solving strategy" (p. 542). In conclusion, "the data for the three participants show the percentage of correct answers the participants received in the ranges that they were in. This study extends the current knowledge base in the area of "remediating academic deficits, specifically solving math word problems, for students with EBD" (p. 546). Overall, the study did help the participants increase with their math abilities. The only downfall with the study is the time consuming aspects and that teachers may not find time to conduct the interventions for the students.

These previous summaries of articles all look at the aspect of helping at risk students in the mathematics area of learning. Also the articles cover a range of time and it is a great deal of time for researchers to study and analyze how young students who are at risk or have mild disabilities learn and could benefit from different strategies. In order to create new knowledge each of these ten studies will be synthesized in the next section.

The body of research on at-risk students in the mathematics classroom has increased through the past few decades. Some of the research that has been done in the past shows strategies and interventions to help improve these students in the classrooms. There have been many studies that use several types of assessments and strategies to benefit these students at risk.

Since the first article that was reviewed was written in 1983 until the last one reviewed from 2011, researchers have studied how to improve students' word problem solving abilities. The study by Wheeler and McNutt (1983) focused on word problems with students and the effect of syntax. Another study that focused on word problem solving was more schema based and was conducted 12 years after Wheeler (Jitendra, et al., 1998). The most recent study looked at that involved math word problems was Alter, et al. (2011). These researchers felt that to improve students' academic scores in mathematics they needed to use different strategies from syntax, to schema based and empirically-based teaching strategies as well. Wheeler concluded that syntactic complexity affects low-achieving eighth-grade students' abilities to solve mathematical word problems. Jitendra, et al. stated that when children are instructed by schema strategy to solve mathematical word problems, their performance on measure of acquisition, maintenance, and generalization increased. Alter et al. focused on conceptual understanding, fluency and problem solving strategies in the mathematics classroom. The findings of this research indicate through strategies in these studies helped improve the participants' mathematical word problem abilities.

Several other studies reviewed looked at the cognitive aspect of teaching students strategies to gain knowledge in mathematics. Montague (1986) studied cognitive verbal math problems for the participants. The researchers studied the effect of an eight- step cognitive strategy on verbal math problem solving performance of six learning disabled participants. Students did improve with the two-step approach and the researchers used the cognitive strategy intervention. Another study by Montague in 1993 also studied students' abilities at three different levels of problem solving ability to solve math word problems. The study showed that the students with LD would not perform as well as the other participants without explicit

instruction in cognitive and metacognitive strategies necessary for solving mathematical word problems. In 2008, Swanson et al. conducted a study that focused on the cognitive growth of students and problem solving ability. They believed that there was a need for more general cognitive processes in the math class. The findings of these studies show that students can excel if mathematical instruction contains additional cognitive solving strategies. Therefore, if more struggling students' instruction contains additional cognitive strategies then their academic score will increase.

Progress monitoring of the students in the math class room can help them with their learning. The studies by Rock (2005) and Bryant, et al. (2011) both involved progress monitoring of the participants. In Rock's study the participants conducted their own progress monitoring with checklists. In the Bryant, et al. study the participants in the intervention compared to students from the same classes and schools who did not participate performed statistically significantly better on the progress-monitoring measure. Combining the findings of these two studies show that students can increase their mathematics scores with progress or self-monitoring.

Woodward (2006) and, Menesses and Gresham (2009) studies focused on peer tutoring and practicing facts through strategies. These two strategies help participants in several ways in the articles. Woodward used multiplication fact sheets to increase the participants integrated strategy instruction with timed practice drills. Woodward showed that the participated improves their skills after four weeks of intervention. Menesses and Gresham conducted a study on peer tutoring. These researchers compared the academic gains of reciprocal peer tutoring, nonreciprocal peer tutoring, and a waiting-list control group. Their findings on the peer tutoring were beneficial for the participants and increased their academic scores.

The purpose of this literature review is to determine what research says about students in mathematics classes that are at risk or have mild disabilities and to research the question, what is the effect of various types of mathematics instructional methods on the academic growth of at risk elementary students? The literature review does not answer the research question but gives an influential outlook into the future and what researchers still can do to enhance students learning. The review contains ten studies selected because their results and findings are appropriately relevant to the research question. A synthesis of their results produces possible answers to that research question. This literature review has also been able to view different strategies that have changed throughout the process.

The findings of this research conclude that students with mild disabilities or are at-risk can be educated with strategies to enhance their learning abilities and help their academic scores. There is the possibility of cognitive strategies, word problem strategies including schema or syntax, and peer tutoring or practice fact sheets. Current or future educators could look at the findings of this literature review and continue to find ways to enhance students' ability to learn in mathematics.

The Literature Review leads to the following research questions:

- What strategies effect students with Attention Deficit Hyperactivity Disorder or are at-risk in the Mathematics classroom?
- Do visuals and/or manipulatives affect student learning in a Second grade mathematics classroom?

In the following chapter, I will detail the methods used in my project. I will evaluate the previous articles and studies to conduct my research. I will recall what I have read and have a better understanding of the subject being reviewed.

Methods

Subjects and Settings

The proposed study is based on the effects of visual stimulation on the mathematics performance of children in second grade with Attention Deficit Hyperactivity Disorder (ADHD). Youth with learning disabilities and attention deficit disorders may score lower on math problems than children without disabilities (Zentall, 1994). Children with attention deficit hyperactivity disorder often demonstrate significant educational and behavioral deficits (Zentall, 1994). This study was conducted in order to show the effects of the intervention of visual stimuli on those students.

For the general framework of this project the study will use quantitative methods. The participants were students in a second grade elementary classroom. The study took place during the students' mathematics lessons. Quantitative methods will show the results of the students work during the intervention. It will be reviewed and show results of students work during the mathematics lessons.

Dependent and Independent Variables

The research setting took place in the students' 2nd grade classroom. They attend a small public school district in western New York. The school population is close to 550 for grades kindergarten- 4th. The percentage of Caucasian students in the elementary school is close to 66% and about 31% Native American. The participants will be in the age range of 7-8 years old. The participants will be both male and female. There will be approximately 16 participants in this study.

The principal investigator selected a 2nd grade class in the school district in which she believed would give the best results seeking her topic. The principal investigator believed the research questions to be studied would fit well with this school district. The participants are also in the age range and learning ability that the principal investigator was seeking to study. The students in the study returned parent signed permission slips to participate in this mathematical study. Male students with ADHD tend to score lower on math achievement (Zentall, 1994). I will review both male and female scores during the study.

The students were exposed to both a high level and a low level within task stimulation during simple mathematics tasks. I wanted to study how the students complete tasks during a stimulated task. Also, see if the students' scores are affected by environmental stimulation.

Data Collection

The study took place in the students' 2nd grade classroom. The participants were asked to complete two different tasks during the lesson. One task was a low within task stimulation and the other task was a high within task stimulation. The first task the participants completed a work sheet of math problems with 15 questions. The paper was white with black font. There was not any color or pictures on the work sheet. The second task, the high within task the students completed questions on the SMARTBoard. The smart board is very interactive, and the students saw see a lot of colors and objects on the board.

The performance measures in the study consisted of the number of problems attempted and the number of problems completed correctly during the session. The time allotted for the math lesson can run from 50-65 minutes. The behavioral measures for the participants were measured on observation, talking/noisemaking, and movement from seat.

Data Analysis

The study was analyzed on how the participants complete their tasks. The results of both tasks will be explored. I hypothesized that using the high within-task stimulations would increase the number of problems attempted and number correct over that observed in the low within task stimulation task.

Before choosing this approach to study I had a few other topics that would have been interesting to work with. Another study topic could have been: How do ELLs (English Language Learners) scores compare with students with disabilities in an elementary classroom? What effect does starting off at a community college, then transferring to a University? What affect does pull out programs have on all students? How does a student transferring to a different school affect the classroom?

This study is predicted that students in a second grade math class are affected by visual stimulation when it comes to completing mathematical problems.

Results

The results of this study took place in a 2nd grade mathematics classroom. There are 16 students that participated in this study. The students were observed and scored on Mathematics worksheets during the lessons studied. The first day the students were observed using several manipulatives including the SMARTBoard, rulers, their papers, paper clips, colored blocks, etc. During the second lesson the students were not given any manipulatives.

The effects that manipulatives have on 2nd grade students can be seen in Figure 1 and Figure 2. During lesson 1, 11 out of 16 students scored higher on the worksheets after they were using manipulatives, 68%. When the manipulatives were implemented in lesson 1, students were listening and cooperating more. The SMARTBoard was used and the students could see bright colored objects to measure. They could use rulers to measure the objects. The students were able to visualize and understand what to measure. The students were trying to use the manipulatives to come up with the correct answer. While the students are working they are using the manipulatives while also learning. There was one female student who received the same score on both days of lessons.

The effects of the students not using manipulatives in lesson 2 is also shown on Figures 1 and 2. Figure 1 shows the male student's results from both lessons and Figure 2 shows the female results of the graded worksheets. 10 students out of the 16 had a lower score on the worksheets when there were significantly less manipulatives used during the lesson. Students did not use rulers or a piece of paper to measure distance. They needed to estimate and not use and tools to help them. The results showed that 63% of the students received a lower grade without using manipulatives during the lesson. The average results between both lessons show that both

the males and females scored higher on the lesson where manipulatives were used. The male students scored an average of 3.5 points higher when manipulatives were used. The female students scored an average of 4.2 points higher when manipulatives were used.

The effects of manipulatives for students with learning disabilities, such and Attention Deficit Hyperactivity Disorder (ADHD), are shown on Figure 3. During the study the students' scores did change between both lessons. The first male student scored higher during the lesson with manipulatives and then scored lower on the lesson that the manipulatives were taken away. The second male student scored slightly lower on the day that the manipulatives were used.

The effects on female students that have learning disabilities were fairly close to that of the male students. The first female student scored higher on the day that the students had used several manipulatives during the lesson. The second female student received the same score on the class worksheets for both days.

The data collects and results will help teachers and educators have a better understanding how students learn with using manipulatives during a math lesson. The results also will help educators and special education teachers in understanding how students with learning disabilities may benefit with using specific manipulatives during mathematics instruction. In the next section, I will discuss the significance of these results and will explore possible avenues for future research projects.

Figure 1 shows the effects of intervention on male students with and without using manipulatives in a 2nd grade Mathematics classroom.

	Boy 1	Boy 2*	Boy 3*	Boy 4	Boy 6	Boy 7	Boy 8	Boy 9	Boy 10	Average
Lesson 1	80	80	65	80	95	100	80	85	95	**76**
Lesson 2	75	70	70	90	90	90	85	75	80	**72.5**

Lesson 1= graded worksheet with manipulatives used

Lesson 2= graded worksheet with no extra manipulatives used

* = student has been diagnosed with ADHD

Figure 2 shows the effects of intervention on female students with and without using manipulatives in a 2nd grade Mathematics classroom.

	Girl 1	Girl 2 *	Girl 3 *	Girl 4	Girl 5	Girl 6	Average
Lesson 1	95	70	60	75	95	90	**80.8**
Lesson 2	90	60	60	70	85	95	**76.6**

Figure 3 shows the effects of intervention on the 4 students in the 2nd grade Mathematics class with learning disabilities.

	Boy 2	Boy 3	Girl 2	Girl 3
Lesson 1	80	65	70	60
Lesson 2	70	70	60	60

Discussion

This study looked at the benefits of manipulatives and visuals and their effects on academic growth in a 2nd grade classroom. The class also had students with learning disabilities present in the room. The study looked at how the student's classroom assignment scores correlated with the use of manipulatives.

The present findings showed that manipulatives in a 2nd grade classroom produced significant improvements on the students' classwork completion of assignments. 11 out of 16 students scored higher on the worksheets after they were using manipulatives. Therefore, 68% of the students received higher scores with manipulatives. Almost all the students were paying attention and following along during those lessons with manipulatives. Students became more involved during the lesson. The scores between when students were using manipulatives were higher than when the student went without. When students use manipulative and hands on learning materials the scores were higher 68% percent of the time overall and 50% higher for students with learning disabilities, while one student receiving the same score during both.

Significance

Compared to research studied by Bennett (2006) students need to be more stimulated to remain engaged in learning. Manipulatives help students with or without learning disabilities gain knowledge to retain the information. The findings show that students will remain engaged longer during mathematics lessons with manipulatives present.

According to the findings of this study, students work well when they see and visualize what they are being taught. During the manipulative lesson the students were able to use rulers, paper clips, their papers, the SMARTBoard, and their desks. The students were able to compare

and visualize during the lesson. They could then see what they were measuring and compare their work. They asked questions and used each other for help.

The students completed the classroom worksheet assignments after the lessons were taught with and without the manipulatives present. The students all worked on word problem strategies to complete the assignments (Alter, Brown, & Pyle, 2011).

In a study by Bryant, Bryant, Roberts, & Vaughn, (2011), the researchers looked at progress monitoring as an important factor in Mathematical strategies in Elementary Students. The 2nd grade students' progress was recorded by the completion of their math worksheets that complied with each lesson and also contained some review questions. By the results of the study the students showed progress when manipulatives were used.

Swanson, Jerman and Zheng (2008) studied how students with special needs may need the extra help while solving math problems. From the study results the students with special needs scored the same or higher 75% of the time. One student scored lower and only by 5 points on the assignment.

The results of this study indicate that visuals and manipulatives do help students in a 2nd grade mathematics classroom. All students can benefit from the way of teaching. Students with or without learning disabilities can see what is going on and imagine how to measure using the rulers and other materials used. Students with disabilities will get the benefit of the lesson by visualizing it as well (Montague & Bos, 1990). Montague and Bos stated that students with disabilities have difficulty applying math skills, visuals can improve their knowledge. During the lesson without manipulatives students seemed confused and scored lower on the assignment (on average 63% of the time).

The current findings indicated that when manipulatives are used in the classroom of 2nd grade math students, with and without learning disabilities, there is a relationship with increased classwork assignment scores. When the manipulatives were used many more students completed homework and earned higher grades and focused more during instruction. When the manipulatives were removed, students' performance on both outcomes dropped and noticeably. These findings are quite important.

When the teacher used manipulatives in the classroom the teacher and students all were involved during instruction times. The students liked being able to see what is being represented by using the rulers. They liked measuring with partners and working together. When the class did not use manipulatives during the lesson the students were more likely to be off task and not following along.

Limitations

There are something's to consider when interpreting these findings of the study even though the study did show some positive results. There was a small number of participants used for the study (N=16), and the location was a rural school district. The study was also conducted over a short period of time. It is quite possible to receive different results over a long period of time. Further research should include several school districts and a longer period of study. The results are also limited because the investigator served as the primary data collector of the work.

Future Research

In summary, this study examined the effects of manipulatives in a 2nd grade classroom on students' classwork assignments, in a rural mathematics classroom in Western New York. Current findings indicated that overall, students perform better and focus more on classwork

when manipulatives are used during mathematics instruction. The students worked well with others while using manipulatives provided. Overall, researchers can conclude that students with or without learning disabilities can perform and understand mathematical concepts with the use of manipulatives. More studies can be performed to understand how students learn during mathematical instruction. What other reasons affect students learning in the mathematics classroom? How will teachers continue to use manipulatives in the classroom? How can manipulatives affect other subjects in the classroom? What other grade levels can benefit from the use of manipulatives? These questions along with many others can keep researchers challenged to discover how children learn in the elementary classroom. Educators need to understand how and what help children learn in all levels of education.

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Appendix

COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI)

HUMAN RESEARCH CURRICULUM COMPLETION REPORT

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LEARNER	Alicia Britt (ID: 2731400)
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INSTITUTION	SUNY - College at Fredonia
EXPIRATION DATE	03/24/2014

GROUP 1.

COURSE/STAGE:	Basic Course/1
PASSED ON:	03/24/2012
REFERENCE ID:	7551995

REQUIRED MODULES	DATE COMPLETED
Introduction	03/02/12
History and Ethical Principles - SBE	03/02/12
Defining Research with Human Subjects - SBE	03/02/12
The Regulations - SBE	03/19/12
Assessing Risk - SBE	03/19/12
Informed Consent - SBE	03/19/12
Privacy and Confidentiality - SBE	03/19/12
Research with Prisoners - SBE	03/19/12
Research with Children - SBE	03/19/12
Research in Public Elementary and Secondary Schools - SBE	03/19/12
International Research - SBE	03/24/12
Internet Research - SBE	03/24/12
Avoiding Group Harms - U.S. Research Perspectives	03/24/12
Vulnerable Subjects - Research Involving Workers/Employees	03/24/12
Conflicts of Interest in Research Involving Human Subjects	03/24/12
SUNY Fredonia State College	03/24/12

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