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Improving the mathematics word-problem skills of an early middle school student

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Improving the Mathematics Word-Problem Skills of an Early Middle School Student

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CHAPTER ONE

Introduction

In this study, a middle school student deemed struggling with reading comprehension and fluency participated in a one-to-one individualized intervention. A reading comprehension intervention was designed for the student because of her demonstrated need in this area. Chapter One describes the student participant and relevant background information. The chapter concludes with the intervention's relevancy to the Common Core Standards.

Student Background

All information regarding CV was taken from her Cardinal Stritch Urban Literacy Center cumulative file and progress reports, past standardized assessments including the Qualitative Reading Inventory, Woodcock Reading Mastery, and Key Math Assessment. Information was also taken from background information/interest surveys completed by CV.

In order to respect the student participant's privacy, she will be addressed by "CV" throughout this study. At the beginning of research sessions on June 24th, 2013, CV was a twelve year, three month old student who just completed the sixth grade at a private school in an urban area. The 2012-2013 school year was CV's first year attending a private school as she previously attended urban public schools grades kindergarten through fifth grade. CV has no diagnosed medical conditions or any other diagnosed academic delays documented, and thus she has never qualified to receive Special Education Services. However, in fourth grade CV's mother expressed concerns about her reading comprehension and fluency. As a result, CV attended the Cardinal Stritch Urban Literacy Center program to address her academic needs.

Implications for instruction included improving writing skills by incorporating more details with the use of different writing organizers. Further Implications for instruction included increasing general reading skills by use of various strategies including improving fluency by increasing reading rate from 115 words per minute (Shurter, 2002), and improving comprehension through strategies such as comprehension monitoring as also suggested in Schurter's 2002 study where he investigated the implementation of comprehension monitoring versus a standard basal reading program with students in grades 3-5. Another study regarding comprehension monitoring conducted by Brown and Palincsar (1984) focused on teaching students to self-question while reading. Their results found that students who mastered this technique improved their overall ability to comprehend while reading. Additional strategies to improve CV's comprehension include buddy reading, creative writing, and book discussions, techniques all proven successful by Reis et al. (2008) where their SEM-R program progressively exposed students to various reading strategies including the three mentioned above.

Common Core Standards

The Common Core Standards (adopted in Wisconsin in 2010) were designed to provide a consistent and clear understanding of what students are expected to learn by content area and grade level (*Common Core State Standards,* (n.d.), retrieved from: http://standards.dpi.wi.gov/stn_ccss). Furthermore, these standards provide a common structure for all American teachers to use when designing instruction. In theory, the implementation of common standards allow teachers to know exactly what content to cover and what a student should know. The intervention implemented in this study aligns with several Common Core Standards in the area of literacy.

A grade seven English Language Arts standard states, "By the end of the year, read and comprehend literature, including stories, dramas, and poems, in the grades 6–8 text complexity band proficiently, with scaffolding as needed at the high end of the range." (CCSS.ELA-Literacy.RL.7.10) This standard general confirms the importance of comprehension while reading for any seventh grade student. The standard acknowledges that a student may read and comprehend within a grade level range. Although, CV is a completing sixth grader, this study is designed to give her support and strategies to move towards reading and comprehending towards the end of the middle school range (this will be discussed further in chapter 3).

Another grade seven English Language Arts standard states, "Cite several pieces of textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text" (CCSS.ELA-Literacy.RL.7.1). This standard emphasizes that a seventh grade student should be able to not only comprehend texts explicitly, but make inferences as well. This study will address CV's ability to make inferences while reading through assessment and the various interventions. Chapter three will go into more details regarding the connection between the Common Core Standards and this study.

The next chapter will take an in depth look at reading comprehension through analysis of several peer-reviewed studies. In addition, the connection between reading comprehension and mathematics will be examined. (This connection will be discussed with regard to CV specifically in Chapter 3) Essentially, the studies selected and analyzed involve research findings relevant to the purpose of this study designed specifically for CV.

Chapter 2

Review of Literature

As a school-aged child I remember hearing Fredrick Douglass' famous quote, "Once you learn to read, you will be forever free." At the time I did not understand how learning to read could possibly make anyone free. However, almost 20 years later, I now understand what he meant. Literacy is indeed the key to freedom. All other worlds of information, every path of higher education, is accessed through one's ability to read. Positions of success and power in this world are inaccessible without literacy.

This chapter will first review five pieces of literature written by professionals in the field of education. The articles were chosen based on their relevance to general literacy and how it relates to the population of students I work with as an Urban Special Education Teacher. The second half of the chapter will examine articles related to general comprehension more specifically, and then math word problem comprehension, which is the specific focus of my research.

General Literacy

This first section of this chapter will review research studies conducted and written by professionals in the field of education. The articles were chosen based on their relevance to general literacy and how it relates to the population of students with whom I work with as an urban special education teacher.

The road to literacy can begin as early as six months old (Applebee, 1978); therefore,

this section begins with a study (Connor & Craig, 2006) on preschool-aged children. The study

examined whether there might be a relationship between African American preschoolers' use

of African American English (AAE) and their language and emergent literacy skills. The study

was conducted in an effort to better understand the persistent difficulties many African

American children experience working towards being able to read proficiently. It has been well

documented that there is a long-standing gap between the reading levels of African American

children and their Caucasian peers. Sixty-one percent of African American children failed to

achieve basic reading levels, compared to only 26% of their White peers (U.S. Department of

Education, 2003). Studies previously indicated that the use of AAE is strongly and negatively

associated with reading achievement for African American students (Craig & Washington,

2004). These researchers hypothesized that the relationship between AAE and reading

achievement is even more complex than the negative linear trend observed in other studies.

Sixty-three African American or bi-racial children (ages 4 and 5) enrolled in pre-school

programs for children at risk for academic underachievement participated in this study. The

children came from two different school districts and a total of ten different classes. There were

a total of five teachers (all White) who each taught two classes of preschoolers (a group in the

morning and in the afternoon). All but one of the teachers had early childhood credentials, all

had bachelor's degrees, and all but one had earned master's degrees. All the teachers and their

classrooms were observed using the Early Childhood Environmental Rating Scale (Clifford &

Harms, 1980), and they were found to be good to excellent quality. In addition, only eight of

the children's parents finished some level of college, and all except one parent completed high

school. The children were also tested for their cognitive ability and there was no significant variance found.

The children were assessed during the fall and spring of the school year. During the fall, the children's receptive vocabulary was assessed using the Peabody Picture Vocabulary Test (Dunn & Dunn, 1997). During this test the examiner asks children to select increasingly unfamiliar target words from four pictures. In the spring the children's AAE use and percent of dialect density measure was taken. Children were told to page through the wordless story book, *Frog, Where Are You?* They were then asked to "read" the book page by page. The advantages within the language sampling context include the fact that the child is reading a book without text. Another advantage is that there's a large body of research on children's oral narratives and emergent storybook readings. Transcripts of the students' "reading" were transcribed orthographically. Ten percent of the transcripts were selected at random and transcribed by a certified speech pathologist trained in the transcribing procedures. The reliability was 92%. The transcripts of the *Frog, Where Are You?* oral narratives were coded for the use of AAE using a pre-developed system (Craig & Washington, 1994). During the spring the students were also assessed in the areas of sentence imitation, vocabulary, letter-word recognition, and rhyming.

Fifty-five of the sixty-three children in this study used AAE forms during their oral narrative. It was found that there was a significant relationship between the frequency the preschoolers' used AAE and their language and emergent literacy skills. Students who used AAE less, demonstrated stronger sentence imitation, letter-word recognition, and phonological awareness skills when compared to preschoolers who used AAE more often. Overall, it appears

the use of AAE is negatively effecting the emergent literacy development of preschool-aged

students, which in turn sets them up to be behind their peers who do not use AAE during their

preschool years. As the authors predicted, the score differences that existed between the low

and high performing kindergarten groups persisted as they progressed through school.

AAE is consistently used by CV; therefore, AAE possibly played a role in her delayed

literacy development as early as preschool. Therefore, I reviewed the following study that

researched the effects of closing literacy gaps as soon as they are known to be existent

following preschool.

The major goal of the next study (Foster & Miller, 2007) was to specify the

developmental paths for phonics and early text comprehension skills of children from

kindergarten through third grade. The authors initiated the study by looking at the relationship

between students with learning disabilities and their history with speech and language services.

Furthermore, Speech and Language Pathologists (SLPs) in public schools are often the first

within the special education department to interact on a diagnostic level with students who are

at risk of developing reading disabilities later in their school careers. From 2000 to 2003, 52% of

students (within the author's school district) identified as having a learning disability in reading

had previously been identified as having speech-language impairments-a finding that has been

substantiated in other reports (e.g., Stothard, Snowling, Bishop, Chipchase, & Kaplan, 1998).

The authors hypothesized that the literacy achievement gap present for many students

(receiving speech and language services) by the time they enter kindergarten must be

effectively closed in the early years of school in order for those students to have an increased

chance of literacy success as they progress academically.

A total of 12,621 students were included in the analysis done for this study. Data from these students were collected from kindergarten through third grade (4 years). Of the students included in the study, 61% were White, 14% African American, 13% Hispanic, and 12% were from other minority groups. The students involved in the study were approximately 50% male and 50% female. There were also students with disabilities whose data were analyzed as part of the study.

Data for the study were obtained from the kindergarten cohort of Early Childhood Longitudinal Study (ECLS-K) that was developed through the US Department of Education (http://nces.ed.gov/ecls/). A nationally representative sample of students was selected using a sampling system. Schools were selected randomly within each primary sampling unit, and students were selected randomly from each of the schools. The ECLS-K focuses on children's early school experiences beginning with kindergarten. The data used were collected during the students' kindergarten years and then during their first and third grade years. The literacy assessment of the ECLS-K of each student were analyzed. This assessment was designed to assess basic literacy skills and reading comprehension.

A standard score was obtained from the ECLS-K literacy assessment taken by each student. Students were then placed in one of three literacy readiness groups based on their literacy assessment standard score in the fall of their kindergarten year. Students who scored 1 standard deviation (SD) or more below the mean were put into the low literacy readiness group. Students who scored 1 SD or greater above the mean were put in the high literacy readiness group. The remainder of the students were put into the average literacy readiness group.

The students' literacy development was followed from fall of their kindergarten year through third grade. The high literacy readiness group began kindergarten with phonics scores that were significantly higher than both the average and low readiness groups. At the end of kindergarten, the mean score differences had narrowed, and by the end of first grade all three groups were within a half of standard deviation with regard to their phonics skill development. By third grade the phonics gap that existed between the three groups had closed.

The authors noted that developmentally phonics skills preceded comprehension skills. At the beginning of kindergarten year, the low and average literacy groups scored very low in the area of comprehension with no notable difference in their scores. However, the high readiness group began kindergarten with progress towards the development of comprehension skills in addition to their relatively good phonics skills. By the end of their kindergarten year, the gap was extended. The average and high readiness groups made significant progress with their comprehension skills, while the low readiness group made no improvements. By third grade, the average readiness group had nearly caught up with the high readiness group; however, the low readiness group never caught up.

The researchers performed a linear regression to analyze the relation of poverty status, parent education level, and the fall kindergarten literacy score to the third grade literacy score of the students involved in the study. The regression was considered significant. The low readiness group was more concentrated with students whose families lived below the poverty level when compared to the other two groups. Thirty-three percent of the families in the low readiness group came from families who lived below the poverty level, as compared to only 14% from the average readiness group, and 4% from the high readiness group. Therefore,

socioeconomic status is an important factor in predicting school readiness. The three readiness groups were also analyzed to determine the percentage of parents who had a high school diploma or less. Fifty-five percent of the students in the low readiness group had a parent with at least a high school diploma. However, 77% of the parents from the average readiness group had at least a high school diploma, and 91% of the parents from the high readiness group had at least a high school diploma.

As this study exemplified, students begin school with varying levels of literacy readiness. Furthermore, the literacy levels these students begin school with impact their third-grade reading performance. The data from the study suggest that students who are at an average readiness level reach a high level of phonics by the end of the first grade, and begin to catch up to the high readiness group in the area of phonics. Therefore, the students in these two groups are ready to transition to the next stage of literacy while in first grade. They spend second and third-grade becoming more fluent in their ability to decode and comprehend text. It was not until the end of third grade that the students in the low readiness group were skilled in decoding to the level that the students in the other two groups had reached back in first grade. However, the average and high readiness groups had already made significant gains in text comprehension by the end of third grade. Essentially, for the low readiness group, one performance gap is traded for another, which confirmed the researcher's hypothesis.

Overall, the authors found that students who were behind in their literacy performance in kindergarten remained behind in third grade unless their performance improved by first grade. Essentially, the score differences between the low and high performing kindergarten groups persisted as they progressed through school as the authors hypothesized.

Furthermore, the findings suggested that children can have experiences with literacy through their parents/caregivers long before they enter a structured school setting. These home experiences with literacy can result in certain students entering kindergarten with a higher "readiness level" than others—a gap that was shown to persist as the students continued through their years of schooling. With regard to CV's home experiences before entering school, her mother recalled that there was no consistency with reading. She would read to and work with CV occasionally, but not on a regular basis.

Moreover, Foster and Miller found socioeconomic status and parental level of education to have a significant effect on a student's emergent literacy skills when entering kindergarten. CV's family qualified as living below the poverty level, and having parents with only a high school diploma which may have contributed to her delays in literacy development according to the findings of the present study (only 55% of parents had at least a high school diploma in the low readiness group as compared to 91% in the high readiness group). Therefore, the road to literacy may be very difficult for certain students. As the last authors analyzed the connection between home circumstances, the following study researched literacy development and early experiences at school. CV's mother believed her early school experiences contributed largely to a weak literacy foundation as she progressed through the elementary school years.

Wade and Moore (1998) focused on literacy development and early experiences at school. The researchers believed that home interactions with parents and care givers were crucial for later literacy development and that book sharing plays a central role in laying the foundation for success with literacy. The researchers followed the Bookstart project in Birmingham, Alabama in 1992. The project gave gifts of books to families of 6-9 month old

babies via health clinics and home health visitors. The researchers hypothesized that the children from families regularly gifted with books would out perform their counterparts who did not receive these books in their literacy abilities and interest in reading upon reaching school age.

There is evidence (e.g. Bryant & Bradley, 1985) that the active involvement of parents through rhymes, stories, and book reading lays the foundation of literacy in a child's years before entering school. Those children who have established literacy foundations by school age are likely to achieve more in their school years. Essentially, children who are ahead when they begin formal reading instruction, tend to stay ahead when compared to their counterparts during their school age years (Bus et al., 1995).

There were 300 inner-city families selected to participate in the pilot of the Bookstart program. The families all had babies approximately nine months old. A follow up was done on 29 of the children two years after the pilot and then subsequently on 41 of the families when the children finally reached school age.

The Bookstart program initially provided 300 families, who had babies who were approximately nine months old, with a backpack containing a children's books, a bookmark, poem card, information about library facilities, and the value of book sharing and book purchase. Questionnaires given to the families showed that they valued the packs that were provided to them. When the children reached school age a sample of 41 of the families gave permission for their schools to be contacted. Access was given to the students' performance on baseline assessments that included reading and various other academic categories. There were

three literacy related assessments tracked including speaking and listening, reading, and writing. The child's achievement was assessed on a 4-point scale for which clear criteria were laid down. For reading, a child scored 0 if there was no observable evidence of developing an interest in books. A score of 1 was given if the child was assessed as developing interest. If a child could recognize familiar words in responding to books they would be given a score of 2. If the child could read to an adult simple books of their choice the highest score of 3 was given.

The results were as the researchers had predicted. The Bookstart group scored higher than their peers in the category of speaking and listening. The Bookstart group as a whole, scored ahead of the comparison group in reading. Amazingly, there were no scores of 0 (compared to 17% of the control group) in the Bookstart group; suggesting the early exposure to print materials elicited an interest in reading.

Essentially, the results of this study suggest that early exposure to literacy is vital to the academic performance of children once they reach school age. The gifting of books in this study may seem insignificant at first thought; however, that small act made all the difference for those children's literacy development.

As shown by the studies in this section, emergent literacy skills can most easily be developed before children reach school age. Furthermore, the use of AAE (as exhibited by the subject in my research) may not necessarily negatively affect a student's growing literacy development in elementary school. In fact, many pre-school aged students may be dialect switching between African American English and Standard American English which suggests emerging metalinguistic awareness (Connor & Craig, 2006). More important than a child's use

of AAE may be the socioeconomic status and level of education of a child's parents as described by Foster and Miller (2007). These factors may have a significant effect on a student's emergent literacy skills when entering kindergarten. However, most important may simply be early exposure to literacy as indicated in the Bookstart program that gifted families of pre-school aged children with books (Wade & Moore, 1998). Essentially, *literacy* can only begin when a child is exposed to *literacy* materials. Furthermore, following a child's initial introduction to literacy, continued development may in part begin to depend on their level of engagement (Kim et al., 2009).

Engagement: Programs for Improving Students' Reading Abilities

Reading engagement is even more important than a student's family experience with literacy (Gambrell, 2011). Therefore, the next section examines READ 180 (Scholastic Corporation 2004), a reading improvement program designed to be highly engaging and Schoolwide Enrichment Reading Model (SEM-R), a reading program described as delightful and highly engaging by the teachers and students involved in the study.

Kim, Samson, Fitzgerald, and Hartry (2009) examined the effects of READ 180 (Scholastic Corporation, 2004), a mixed methods literacy intervention on measures of word reading efficiency, reading comprehension, and vocabulary, and oral reading fluency. Secondly, the researchers set out to examine whether print exposure among children in an experimental group would explain variance in posttest reading scores. The researchers hypothesized READ 180 would have a positive impact on all categories listed above and that the variance in

posttest reading scores would be explained by the amount of print exposure amongst the students.

The study was conducted in a high poverty school district located in southeastern Massachusetts. The students were elementary aged and recruited from their schools that contained a large percentage of struggling readers. Struggling readers were identified due to their lack of proficiency on the Massachusetts Comprehensive Assessment System (MCAS) which is a standards based assessment on the states language arts curriculum. Black and Latino students (70%) comprised the majority of the students who participated. In addition, 81% of the students received free or reduced priced lunch.

The READ 180 program was administered after school four days per week, for 23 weeks, from October 2005 to April 2006. There were a total of 20 certified teachers involved in this study. Ten teachers taught the READ 180 program and the other 10 teachers instructed according to the normal after school program, which included a literacy curriculum. The READ 180 program consisted of three twenty-minute literacy activities. The first activity was individualized computer-assisted reading instruction with videos, leveled text, and word study activities. This part of READ 180 was likely the most engaging activity for students as they were constantly interacting with the computer program. The second activity was independent and modeled reading practice with leveled books. Students would read (or have the text read aloud to them by a staff member) books based on their individual reading levels and interests. The third activity was teacher-directed reading lessons tailored to the reading level of children in small groups. These activities were teacher led and meant to be interactive. On the contrary, the regular after-school program consisted of teachers selecting from 16 different enrichment

activities that were designed to improve student attendance. The program was not designed or focused on improving student reading skills (before READ 180).

When the study concluded it was found that there were some significant differences amongst the performance of the students on the MCAS in the two groups. However, both groups remained below proficient. The READ 180 group scored significantly higher in oral reading fluency. The READ 180 group also had significantly higher attendance throughout the study, indicating that the content may have kept the students engaged. However, there was no significant difference in comprehension performance when the two groups were compared.

Although there were no notable reading comprehension gains, the researchers found students to be highly engaged in the READ 180 material, an important factor in making gains in the area of literacy (Gambrell, 2011). In the next study Reis et al. also analyzed the effects of a highly engaging reading program on reading comprehension and fluency for students grades 3-5. The study utilized various reading strategies, two of which were used in the study with CV including what they referred to as buddy reading and reading discussions.

Reis, Eckert, McCoach, Jacobs, and Coyne (2008) examined the effects of an enriched reading program, School Wide Enrichment Reading Model (SEM-R). The researchers used SEM-R in comparison with basal reading programs to investigate the addition of planned enrichment strategies and independent reading on students' reading achievement. The researchers hypothesized that SEM-R compared to basal programs would increase students' reading achievement.

The participants for this study included 558 students and 31 teachers. Of the total students, there were 313 who participated in the experiment group and 245 in the control group. All students were in grades 3-5 with about an even distribution of boys and girls. Students were from two rural elementary schools. The student make-up was as follows: 60% White, 29% Hispanic, and 11% were from other various minority groups (302).

Students were randomly assigned to participate in SEM-R instruction or to continue with their regular reading instruction. The teachers were also randomly assigned to teach the SEM-R curriculum or serve as a control and continue to teach their normal reading program. The SEM-R treatment group of students participated in one hour of SEM-R instruction and one hour of the school's regular reading program each day of the study. The control group of students participated in two hours of the regular reading program each day. The regular reading program consisted of traditional instruction in language arts including various writing and spelling activities. The students usually spent the end of each session reading a book of their choice with no real monitoring of their chosen material.

As mentioned, the SEM-R program emphasized enjoyment in the process of learning, with a focus on planned, systematic enrichment experiences. The SEM-R included three general dynamic phases of reading instruction: broad exposure to areas in which students might have interests, trainings and methods instruction, and student opportunities to pursue self-selected topics of interest. In Phase 1 of the SEM-R, teachers selected literature to read aloud, combined with instruction in higher-order questioning and thinking. The purpose of this phase was to increase student exposure and build their interest in literature, thus teachers introduced a new book each day, rather than the traditional model of reading an entire novel in class. The time

spent on this phase routinely lasted 15-20 minutes, decreased over the course of the intervention to provide more time for the other two phases of SEM-R.

Phase two of the SEM-R focused on the development of students' self-regulation skills within time dedicated to supported independent reading (SIR) of selected books, combined with individualized, differentiated reading conferences with their teachers. SIR was defined as students' reading silently from self-directed literature that were slightly above their reading level. The appropriate reading match was assessed through the conferences with teachers 2 to 3 times a week. The amount of time spent reading was slowly increased throughout the intervention—students started with only 5-15 minutes of reading a day, and teachers added 1-2 minutes each day, eventually reaching 35-45 minutes of independent reading each day.

The third phase of SEM-R involved teachers moving students towards self-selection of enrichment activities, rather than teacher-decided activities done in phase one of the intervention. Self-selected activities included (but were not limited to) exploring new technology and engaging in discussion groups, creative writing, buddy reading, creativity training in language arts, learning centers, interest based projects, continuation of self-selected reading, and book discussion groups. The intent of phase 3 was to provide time for developing and exploring the students' interest in reading.

The SEM-R students also received additional services. They were given interest and learning style assessments in order to identify students' interests and encourage them to further pursue them. Secondly, students' curriculum was modified and compacted to avoid the boredom of repeating content that was already mastered if necessary.

The researchers found that students in the experimental group using the SEM-R program were found to be more delighted to read challenging and interesting books of personal interests. This approach resulted in increased reading fluency for these students. Essentially, the findings of this study suggested that an enriched reading program designed to challenge, yet highly engage, students in sustained independent reading may produce more desired outcomes in reading performance than basal reading programs alone.

The section indicated there has been success with improving literacy skills with school aged children using engaging reading programs. The SEM-R method (Reis et al., 2008) used strategies such as gradually increasing students' time spent reading independently-a strategy that proved very successful, and reading discussions--where students simply talked to their peers about the text they were reading. However, significant improvements were only noted in the area of oral reading fluency. In addition, although the 2009 study by Kim et al. does not completely support the findings of Reis et al. (2008), there was one significant substantiation. Reis et al. indicated again that engagement is an important factor in improving literacy—specifically oral reading fluency. Kim et al. examined the effects of READ 180 which mixed video, computer programs, and highly engaging text with their below average readers. The students even had significantly higher attendance as compared to the control group in the study.

The present studies did indicate literacy improvement; however, gains were primarily in the area of fluency rather than comprehension-which they also hypothesized would significantly improve. Although CV could benefit from improved oral reading fluency, my intervention with her focused on reading comprehension. Therefore, the next section looks at

reading comprehension specifically. Various comprehension strategies and their impact on a struggling readers will be analyzed. Essentially, a great deal of thought, including the dissection of information discussed in the next section took place when deciding what comprehension strategies would be used with CV.

Comprehension

Although Merriam Webster's Dictionary (www.merriam-webster.com) simply defines comprehension as the ability to understand the road to reading comprehension can be *not so simple* for the many students who struggle to understand what they are reading. However, there have been certain methods and strategies that have proven successful with regard to improving the reading comprehension of struggling students. Thus, the following research studies analyze comprehension versus fluency and the impact of various reading comprehension methods.

Historical data have continuously indicated comprehension as an area of weakness for CV--even though she has consistently performed at average levels in the area of reading fluency. In the next study, Applegate, Applegate, and Modla analyzed comprehension versus fluency as it related to students deemed "strong readers" by their teachers and parents. There are often "great readers" in classrooms, students whom teachers are drawn to call on to read because they read loud and clear with great fluency. Their study investigated whether strong fluency skills necessarily equals strong comprehension skills in students grades 2-10.

Fluency is a lot more complicated than it may appear at first thought. Does strong oral fluency precede comprehension? LaBerge and Samuels (1974) proposed the idea that reading

requires two central cognitive tasks: word recognition and comprehension. They believed that if readers have not developed automaticity in word recognition, then their cognitive efforts would be expended decoding rather than understanding what they are actually reading. Therefore, LaBerge and Samuels believed fluency skills must precede comprehension; and thus a strong fluent reader *must* be able to better comprehend because their brains are freed up to do so. However, research on this fluency vs. comprehension subject have proven otherwise over the years. One such study involves reading specialist professors Applegate, Applegate, and Modla (2009) who were appalled that students were still routinely being considered "good readers" solely based on their reading fluency abilities; even though some of these students could barely comprehend what they could read so eloquently. Thus, in their study, Applegate, Applegate, and Modla (2009) aimed to investigate the idea of whether students labeled highly fluent readers were also skilled in comprehension.

The sample in this study included 171 students in grades 2 through 10 residing in Pennsylvania, New Jersey, and Delaware who were all labeled by their teachers or parents as skilled readers. The sample included 60 males and 111 females. The majority of the students attended public school, and 86% were white, while 14% were from various minority groups.

Each student was assessed using the Critical Reading Inventory-2 (CRI-2) by Applegate, Applegate, and Quinn (2008) at their grade level. The CRI-2 consists of a narrative or informational passage (pre-primer to grade 12), a retelling rubric, a fluency rubric, and text-based inference, and critical response questions. Each student read one passage orally and a second passage silently. For each passage, the student provided a retelling and then answered 10 comprehension questions (8 explicit and 12 implicit).

Students' scores on the comprehension portion of the assessments were divided into three categories. Students receiving a score of 85% or higher were considered advanced in the area of comprehension. Students who scored between 63% and 80% were considered proficient, and students who scored 58% or below were considered struggling with comprehension. Thirty percent of the students considered "skilled readers" by their teachers and parents scored in the advanced range, 36% scored in the proficient range, and 33% scored in the range of "struggling with comprehension". Essentially, a third of the students praised for their reading skills, could not even understand what they read. After further analysis of their data, the researchers found that many of the struggling readers scored significantly higher on the text based explicit questions, and struggled on the implied higher order comprehension questions.

As stated above, the data pointed to fluent readers struggling with primarily implicit critical thinking comprehension questions. Thus, many students able to read fluently and answer low-level text comprehension questions are often mistaken as having overall strong comprehension skills. Furthermore, these results indicated that the relationship between students' reading comprehension and fluency is unclear. There is no certainty that greater fluency equals greater comprehension. The reading comprehension results (advanced, proficient, and struggling) were actually split fairly even between highly fluent readers and thus assumptions regarding comprehension levels based on fluency should not be made as results vary for each individual student. The study suggests that it is important for educators to consider every area of our students' literacy needs. It may appear a student is a great reader,

however, as this study displayed, that same student may actually need intervention in areas

outside of fluency, such as comprehension.

The findings of the present study by Applegate (2009) held true with my student CV as

she has been considered a fluent reader relative to her peers according to historical

information in her cum file. Teachers would state that she read clearly, with good inflection,

and at an appropriate rate. However, according to standardized tests, her comprehension skills

were below average when compared to her age and grade level peers. Therefore, an

intervention in the area of reading comprehension was implemented for this study. Thus, the

next study by McKeown et al. (2009) analyzed different methods of comprehension instruction;

including a more traditional method and a strategies-based method.

There has been criticism for years that very little went on in classrooms that could be

called comprehension instruction. The purpose of McKeown, Beck, and Blake's 2009 study was

to address the need for more precise understandings of present-day comprehension

instruction. They did this through the implementation of standardized lessons on common texts

for two approaches of comprehension instruction. The first being a strategies approach, and

the second, a content approach. The authors hypothesized that if taught explicitly, students can

have success with both the strategies and content approach of teaching comprehension.

Student participants were all in the fifth grade and from six different classrooms in one

school in an urban part of southwestern Pennsylvania. In 2004-2005 the school was identified

as "in need of improvement" by the Pennsylvania System of School Assessment, with 48% of

fifth graders scoring at or below basic in reading. Fifty-eight percent of the students were Black, and about half of the student qualified for free or reduced-price lunch.

The research involved a two-year study in which the researchers developed, implemented, and compared standardized instruction for representations of two major approaches targeted to enhance comprehension. Students were divided into 3 groups: strategies instruction, content instruction, and a control group that was given basal instruction.

The strategies group was taught to use specific procedures to guide their access to text during reading. Strategies taught included: summarizing, making inferences, and student question generation. The content group focused student attention on the content of the text through general, meaning-based questions about the text. Essentially, students would read their text, and then be given explicit and implicit questions regarding what they read. The questions would be discussed aloud or completed independently.

Comprehension lessons (either content or strategy based) were scripted and designed around the texts being used in the classroom (all three groups used the same texts). Each week the text and comprehension lessons were accompanied by another shorter text, and activities in fluency, writing, vocabulary, word study, self-selected reading, and other typical language arts practices. This procedure was then carried out in the same way the next year with a new cohort of students.

When the groups were assessed it was found that the content approach group slightly outperformed the other two groups, with the strategy group performing the second best. The researchers believed that the very stringent design approach in the study made it predictable

that the differences were so small, especially since all three approaches used high quality

scripted lessons, and all the teachers were trained, observed, and given feedback.

In this study, the strategies approach to teaching comprehension was used when

designing the intervention for my student. I selected this method because it seemed CV's

current classroom instruction was already based on the content approach, according to

informal conversations with CV and her mother regarding her classroom experience. I wanted

the intervention to expose her to a method with which she wasn't very familiar. The authors of

the next study explored more strategies and implementation methods of reading

comprehension instruction.

The purpose of Ness' (2009) study was to identify the frequency of reading

comprehension instruction in middle and high school social studies and science classrooms. The

author also set out to explore teachers' perceptions and beliefs about the need for reading

comprehension instruction. According to Greenleaf and Heller (2007) today's middle schools

and high schools are filled with students who struggle with the complex academic and literacy

tasks they encounter in their content area classes. Furthermore, according to the Alliance for

Excellent Education, approximately eight million students in grades 4-12 read well below grade

level. According to Biancarosa and Snow (2006) of those below grade level readers, nearly 70%

struggle with reading comprehension. For this study Ness defined comprehension as, "the

process of simultaneously extracting and constructing meaning through interaction and

involvement with written language" (p. 143). Ness hypothesized that reading comprehension is

generally not being taught in content area classrooms, otherwise the enormous number of

students reading below grade level would be significantly smaller.

Data collection occurred in two rural schools in Virginia during three consecutive months of the 2005-2006 academic school year. The schools' standardized test scores were at or above average. The ethnic makeup of the school was as follows: 90.99% White, 6.45% Black, .19% Native American, .45% Asian, and 1.32% Latino. In addition, 25% of students participated in the federal free lunch program and 1.7% of the students received English as a Second Language support. Twenty-eight percent of students read on grade level, 32% read above grade level, and 40% read below grade level. The teachers from the described schools were randomly selected. Twenty-three science and social studies teachers were contacted via email and mail and asked to participate. Teachers were simply told their instructional strategies were being observed for the study in order to avoid influencing their teaching. Eight teachers participated in the study. There were two middle school social studies and science teachers, along with, two high school social studies and science teachers. All of the teachers held state certifications in the content areas in which they were teaching.

Data for the study came from two sources. The first source was 2,400 minutes of direct classroom observation over a three-month period. Each teacher was observed for a total of five hours, broken into thirty-minute increments. Teachers were fully aware in advance of the times the observer was coming into the classroom. However, observation times were scattered so each teacher was observed during a variety of periods at a variety of times. To determine whether the inclusion of reading comprehension instruction was occurring during observations, a coding system from the researcher's previous work was used. Instruction codes fell into one of two categories. The first being non-comprehension instruction, and the other being comprehension instruction. Because the study relied on the Ness' interpretation of the codes

being used, a reliability check was done prior to each formal observation. This consisted of the researcher watching a video of a secondary classroom and coding it. A well-trained doctoral student would then record codes for the same video. These checks established an intra-coder reliability of 0.92.

The second source of data was open-ended teacher interviews following the completion of the classroom observations. Each interview was an hour long. The purpose of the interview was to examine the teachers' instructional strategies with regard to content area literacy and reading comprehension. According to Ness (2009), the teachers were asked to "define and explain the reading comprehension instruction they provided, to discuss their beliefs about reading and literacy in their classrooms, and to explain their instructional priorities and challenges" (p. 151).

In 2,400 minutes of observed instruction, a total of 82 minutes of reading comprehension instruction occurred. Therefore, over the course of Ness' study, reading comprehension instruction accounted for only 3% of classroom observations. Thus, the researcher's hypothesis was correct. There was little to no reading comprehension instruction being taught in content area classrooms on the secondary level. The teacher interviews showed that content teachers were not clear as to what comprehension instruction was. The majority felt unequipped and not responsible for providing reading comprehension instruction on the secondary level. Ness concluded that secondary teachers are not using their instructional time to explain, model, and coach student through reading strategies and unless trainings or professional developments convince teachers to value comprehension instruction, student understanding of their content level text, and any other text will not improve.

It is imperative that teachers explain, model, and coach students in comprehension strategies. In the present study, explicit comprehension instruction was included as an integral part of the procedures in order for the student to adequately learn how to use them.

The student in this research study is of middle-school age and below average in her comprehension abilities. Therefore, similar to Ness' 2009 study, explicit comprehension instruction was imperative to CV's success with learning comprehension strategies. She needed to be taught various comprehensions strategies in a step by step process.

Comprehension skills can seem inherent or, at times, difficult to teach; however, studies such as Mckeown et al. (2009) have demonstrated success with teaching comprehension skills. With organized and structured instruction, Mckeown et al. were able to increase the comprehension skills of students at an almost equal rate using both a content and strategies approach. Their two types of instruction were very different; however, all teachers were trained extensively and the strategies were implemented with fidelity, suggesting consistency in instruction may play a large role in whether gains are made. Furthermore, comprehension skills must continue to be taught as children progress through school. Ness (2009) found that only 3% of instruction time was dedicated to teaching comprehension on the high school level. The time spent on comprehension instruction must be increased in order to improve the performance in older students—it will not happen automatically. Finally, the study by Applegate et al. analyzed whether strong fluency skills equaled strong comprehension skills—and found that strong fluency skills do not necessarily equal strong comprehension skills. That study lead me to the next area of my own study: would not only strong fluency equal strong comprehension, but would improved comprehension skills transfer over to improved performance on math word

problems? The next section looks at that very relationship: reading comprehension and how it relates to mathematics.

The Relationship: Reading Comprehension and Mathematics

When people think of mathematics they think of numbers, equations, and, sometimes, even shapes. Literacy is not routinely thought of when people think of mathematics. However, literacy is a large part of mathematics, and just may be the missing piece of the puzzle for many students struggling with math today in the classroom. Numerous studies have indicated a substantial correlation between a student's achievement in mathematics and reading (Flem & Sovik, 1993). Therefore, the following studies demonstrate how literacy, particularly reading comprehension, is an essential skill needed for students to be successful with math word problems especially.

Sovik, Frostrad, and Heggberget (1999) studied the relation between reading comprehension ability and strategies used to solve word problems in math. They hypothesized students who excel at both arithmetic and reading use deductive strategies more often than students weaker in one or both areas.

The sample consisted of students in 4th grade from a large city in Norway. Five students were selected from various groups. Group 1 consisted of students who were above average in math and reading. Group 2 consisted of students above average in math but below average in reading. Group 3 consisted of students who were below average in math but above average in reading. Group 4 consisted of students below average in both reading and math. The students

were placed in the various groups based on teacher rating and their performance on standardized tests.

The students in the study took 3 math tests, each of which consisted of 6 written word problems. The first test was based on addition, the second on subtraction, and the third on multiplication and division. These tests were administered in a one-on-one setting to determine the strategies students used most often. The strategies students chose to use were classified as either deductive (based on retrieval) or procedural (i.e. counting with fingers).

The results indicated that students in Groups 1 and 2 (students above average in both reading and math and students above average in math and below average in reading) used deductive reasoning more than students in Groups 3 and 4. The strategies of students in Groups 1 and 2 (skilled in both math and reading and skilled in math but below average in reading) did not seem to differ on the addition and subtraction tests. However, the strategies between Groups 1 and 2 did differ with the multiplication and subtraction tests. Therefore, the researchers believed that further research needed to be completed in the area of "strategy use" before they could reach a solid conclusion regarding specific strategies used by students with strong math and reading skills.

Although specific strategies used by those who performed strong in both reading and math word problems could not be concluded, results clearly indicated reading comprehension was substantially linked with math word problem performance. The researchers found a moderate positive correlation between reading comprehension and math performance ($r = .5$).

Essentially, the correlation confirmed that as students reading comprehension increased, their performance on math word problems increased as well.

The present study found there to be a relationship between reading performance and math word problem performance leading me to attempt to explore this connection in the study I conducted with CV. However, the specific strategies that made the students in the Sovit et al. (1999) study successful were unclear. Therefore, the next study examined specific comprehension strategies and how they might have affected performance on math word problems.

Schurter (2002) stated, "Mathematics students traditionally have great difficulty in solving word problems. They frequently state that they don't know what to do. Their real problem may well be that they don't know what it is they don't understand" (p. 22). Therefore, in this study Schurter investigated using comprehension monitoring as a technique for problem solving. Comprehension monitoring is generally defined as the awareness and control of one's understanding or lack of understanding. Schurer hypothesized that there would be a significant difference in performance on a mathematical problem-solving final assessment given to students who were taught to use comprehension monitoring throughout the semester compared to those who are not. He predicted the students taught comprehension monitoring would greatly outperform the students who were not.

The sample for the study was selected from developmental mathematics students at a university in San Antonio, Texas. The university had an enrollment of about 3000 students at

the time, with 54% being Hispanic, 26% White, 6% Black, 2% Asian, and 12% were of other ethnicities. Almost 70% of the students were female.

The study compared the performance in mathematical problems of students in one control and two experimental treatment groups of developmental mathematics. The control section was taught by an instructor who had no involvement in the research of comprehension monitoring and did not use that strategy within his instruction. The other two sections were taught by the researcher. This was an obvious downside of the study: the fact that the researcher with vested interest in the study taught the experimental group. This may have skewed the data found in this study.

The first experimental group was taught problem solving with an emphasis on comprehension monitoring. The students were taught to question their understanding of all aspects of the problem-solving process. The students received a checklist entitled Self-Check Your Understanding. The checklist was made into a large poster-board display that was placed at the front of the room at each class meeting and referred to by the instructor during all problem-solving instruction. The second experimental group was taught to use Polya's four-step method in conjunction with comprehension monitoring as a strategy for problem solving. Polya's method was presented to the students as a framework for developing the self-questioning techniques. Students were given the checklist mentioned above along with a paper copy of Polya's method which was also made into a large poster and put in the front of the classroom for consistent reference when solving problems. The strategies were taught in an interactive manner and demonstrated in a variety of contexts. Both strategies were also taught in conjunction with content. The instructor would use metacognition to model the strategy.

Specifically, the question would be read out loud and then each of the points of the particular strategy (comprehension monitoring or Polya's) that was being taught would be addressed with regards to the problem. Students were explicitly informed as to why these techniques were being taught, when they could be used, and how they could help them be successful with problem solving within math word problems.

Before the experiment, homogeneity of the sample was confirmed through a pre-test that was given. Therefore, there was no significant difference among the three groups' math word problem performance before the interventions were taught. An analysis of the posttest given to all participants showed that both of the experiment groups scored significantly higher on the posttest (which was the final exam) than the control group. Therefore, results of this study supported the position that students who receive increased emphasis in the use of comprehension monitoring strategies performed better in mathematical problem solving than students who did not receive such instruction.

As mentioned earlier, there may have been some difference attributable to the difference in instructors, such as the control group was taught by a poor quality instructor. However, that was not the case. The instructor who taught the control group had many years of experience, and was considered one of the best instructors of developmental mathematics. Overall, the comprehension monitoring and Polya plus comprehension monitoring proved to be very successful strategies.

Schurter (2002) looked at comprehension monitoring-a strategy shown to be successful in the study conducted. This study showed that students who received increased emphasis in

the use of comprehension monitoring strategies performed better in mathematical problem solving than students who did not receive such instruction. Since my study incorporated using comprehension strategies, I chose to use comprehension monitoring as a strategy with CV in hopes of finding the same success as Schurter (2002). In the next study McIntosh (1997) researched another comprehension strategy that involved using a reading guide as a tool to comprehend math word problems.

McIntosh's article (1997) presented her findings after teaching her mathematics students to use a three-level reading guide to help them comprehend and solve word problems. She used a fading instruction model to teach this three-level reading guide. The purpose of the study was to determine whether the three-level reading guide in mathematics would allow students to become more independent in solving mathematics word problems as she believed that most students are highly dependent on their teachers when attempting to solve mathematics word problems. The author hypothesized that students who were taught and then consistently used three-level reading guides would outperform students who did not use this strategy when assessed on their ability to solve math word problems.

The sample consisted of a ninth grade Algebra I class. The students self-identified as having difficulty and a lack of understanding on how to solve word problems in mathematics. All the students were from one classroom in a rural school. The ethnic makeup of the students was not given.

After several years of teaching, McIntosh found the majority of students in her mathematics classes struggled with word problems. The three primary complaints were that

they could not decide what was important in the problem and what was not, they could not

determine which information in the problem would help them and which information was

meant for distraction, and they could not figure out how to compute the solution once they

figured out what the problem was asking. McIntosh decided to use fading instruction to teach

the three-level reading guide which she predicted would increase the students' individual

success solving word problems. Fading instruction is essentially the gradual release of task

completion responsibility to students. More specifically, the idea is that when a task is first

introduced to students, the teacher is completely responsible the modeling and completion of

the task, and the students are then guided through additional practice until they are eventually

able to practice or apply what they learned independently.

McIntosh introduced the three-level reading guide by first asking her students what

literal, *interpretive,* and *applied* meant (the words were displayed on poster strips). After some

student discussion she informed the students that the words represented three different levels

at which a person could read. She then asked why a person would need to read at each of these

three levels and received answers that showed a basic understanding of the reasons. McIntosh

then discussed why they might need to read a word problem at those three-levels. She then put

poster strips up that renamed the original words she posted. She replaced *literal* with *facts of*

the problem, *Interpretive* with *mathematical ideas and interpretation,* and *applied* with

numerical depiction. She then posted and introduced one last word which was m*etacognition.*

She proceeded to model the strategy she was teaching them (three-level reading guide) using

metacognition or "thinking about your thinking". The three level reading guide she modeled

consisted of a sheet of paper with the problem and three sections (*facts of the problem,*

mathematical ideas and interpretation) with directions on how to fill out each section*.* McIntosh modeled filling out each section using her think aloud teaching strategy. In the first section she listed explicit facts stated. In the second section she wrote how she would symbolically interpret various information given in the problem (e.g. numbers of mowers to be sold = n), and in the last section she listed possible ways of solving the problem. Students were then given their own problem to complete using the three-level reading guide. This time they were given minimal teacher assistance, and finally they were given a problem and given no assistance unless they needed it.

McIntosh assessed the students' success in terms of whether they could now independently use the three-level reading guide. She did this by asking them to explain the process she taught them, *to her,* in written form without using any notes. Every student was able to produce an explanation of a three-level reading guide and successfully complete the word problem using the guide, thus McIntosh's intervention was a success thus far. The article does not get specific in terms of how success varied amongst students who regularly used the three-level reading guide versus those who didn't. McIntosh ended the article by stating, "teachers in the mathematics classroom are not expected to be reading teachers, but it behooves us to draw on strategies that have been found beneficial by reading teachers" (2007, p. 31). Thus, mathematics teachers should use strategies proven successful in areas of literacy. Therefore, my study with CV investigated whether successful literacy strategies would potentially cross-over into mathematics. However, in order to begin to solve a word problem using any literacy strategy, the text must be broken down and important information pulled

out. The next study examined how students select important or solution relevant information when reading math word problems.

The purpose of the study conducted by Moreau and Coquin-Viennot (2003) was to try to specify the nature of representations constructed during the reading of a word problem, by researching how upper elementary-aged students with either a high or low ability in mathematics select different types of information. According to Kintsch and Young (1992), the understanding of a word problem leads to the construction of several levels of representations that include, textual or text based, and situational or high level. The authors hypothesized that the difference between good and poor problem solvers would come from a difference in representation, and, more particularly, the use of different comprehension strategies. More specifically, they hypothesized that participants of a higher mathematical ability would adopt a differentiated selection strategy which included a high selection of solving information in the two tasks, and an increase in the selection of situational information. On the other hand, they hypothesized that participants with a lower mathematical ability, who may also have lower comprehension abilities, would use less differentiated information selection than those of the higher ability group. They predicted they would instead select narrative information to the same extent as situational information.

The participants in the study were 91 fifth grade students (average age being 10 years, 9 months). The students were assigned to two groups: 56 students with higher abilities in mathematics (high) and 35 students with lower abilities in mathematics (low) on the basis of their teachers' assessments. The assessments were made with regards to mathematics in

general and problem-solving in particular. The students chosen were ages 10 to 11 (5th grade) since they had sufficient basic math knowledge to be able to solve addition problems.

The experiment used four "changeable" problems, made up of the following statements: three indispensable numeric, one indispensable non-numeric, one question, two initiating events, two setting, three explanation, four temporal, and one narrative. The experiment was run collectively in a regular classroom setting. Each student was distributed a booklet in which there were two problems of similar structure. In order to control for topic effects, students were assigned randomly to two text arrangements (1 and 4 or 2 and 3). The word problems were divided into segments based on the types of information mentioned above. Problems were presented to students (one on each page) in a booklet form. The problems were in the form of a list of segments. Opposite each segment there were two boxes: the first column of boxes was for the first task and the second for the second task. For each problem students carried out the double selection task. They first check marked the sentences that would make the problem text as short as possible while remaining solvable and understandable. There were specific instructions given explaining this task. Secondly, the children were asked to select the sentences that would make the problem text easier to understand. They were again given specific instructions further explaining this.

The results obtained in this study indicated that fifth-grade students make a valid distinction between the information that is indispensable for problem solving and information that is not. Overall, the solving information was selected in a greater proportion than the situational information. However, the participants of a higher mathematical ability made more relevant selections than that of the lower ability participants. More specifically, they gave more

importance to the information which explained the situation in comparison to the narrative information, which was not the case with participants of a lower mathematical ability.

For many, math and literacy are separate subjects. Especially, for some teachers who only teach one subject. Math is Math, and English is English, with no overlap in between. However, research has shown that there is significant overlap between Math and English as indicated with the moderate positive correlation found between students' reading comprehension ability and their math word problem performance (Sovik et al., 1999). Furthermore, Moreau and Coquin-Viennot (2003) suggested that students with higher comprehension skills are able to distinguish between solution relevant information in word problems, whereas students who struggled with comprehension could not seem to pull out the correct information needed to solve the word problems. Even further, Mcintosh's 1997 study she found that a three-level reading guide, routinely used in reading classes, improved students comprehension of math word problems, resulting in overall improved math word problem performance. In addition, there are several other reading-based strategies that have proven successful in the area of mathematics, another example being comprehension monitoring. Schurter (2002) found that students who received increased emphasis in the use of comprehension monitoring strategies performed better in mathematical problem solving than students who did not. Essentially, math and literacy are intertwined, and need to be taught cohesively in order for students to reach their potential with regard to fully comprehending the math word problems they are trying to solve.

Essentially, literacy is the foundation of all aspects of academia and opportunity in life. As shown by the studies in the first section of this chapter, emergent literacy skills can most

easily be developed before children reach school age; however, it is not an impossible feat

thereafter; although there may be various barriers such as the use of AAE (Connor & Craig,

2006), socioeconomic status, and parental level of education (Foster & Miller, 2007). However,

most important may simply be early exposure to literacy as indicated in the Bookstart program

that gifted families of pre-school aged children with books (Wade & Moore, 1998).

The second section reviewed the results of two different reading improvement

programs designed to in part positively affect students' reading comprehension abilities (Kim et

al, 2009 & Reit et al., 2008). The programs both emphasized the importance of engagement and

believed it played a large role in the success of the programs. Although improving

comprehension was a potential outcome of the program, gains were primarily made in reading

fluency for the students involved. Therefore, I decided to look at specific successful strategies

regarding reading comprehension in the next section.

The third section of this chapter focused on reading comprehension. McKeown et al.

(2009) researched two different ways of teaching comprehension. The method (content

approach) was more traditional and primarily involved students being asked explicit and

implicit questions while reading a text. The second method (strategies approach) involved

teachers explicitly teaching comprehension strategies. Both methods were implemented at the

same school and used the same text. The results showed comparable results between the two

method; however, I decided to use the strategies approach with CV because it is imperative

that teachers explain, model, and coach students in any concept they want them to master--

comprehension included.

The final section of this chapter looked at the relationship between reading comprehension and math word problem performance. Therefore, research conducted by Sovik et al. (1999) showed there to be a moderate positive correlation between fourth graders reading comprehension performance and their success solving math word problems. Thus the crux of my study: if CV's comprehension was improved after learning various comprehension strategies, her performance on math word problems would ultimately improve as well.

Reading comprehension is the quintessence of literacy as there is no value in reading if one cannot understand what they are reading. Even more, reading comprehension is a non-negotiable aspect of potential success with mathematics as suggested in Sovik et al's 1999 study. Overall, literacy, and comprehension specifically must be prioritized in the early elementary years (Foster & Miller, 2007) in order to build a solid foundation for all subject areas including mathematics. However, if literacy skills are not prioritized early in a child's life, they can still experience literacy success if their teachers' instruction explicitly explain and model methods to build various skills such as comprehension (Moreau & Coquin-Viennot, 2003).

CHAPTER 3

Procedures

The purpose of this study was to investigate the effects of a strategy based intervention on a student deemed struggling with reading comprehension and solving math word problems. Research shows that the implementation of comprehension strategies can improve a student's overall reading comprehension performance (Beck, Blake, & Mckeown, 2009). In this chapter, a description of the student participant is provided. The intervention designed and implemented for the student is outlined along with the data that were collected to measure the effectiveness of the intervention.

Sample Population

The sample in this study included one middle-school aged child who is referred to as "the subject" or by the pseudonym "CV" (for privacy purposes) throughout the study. The subject was a twelve year, three month old Black female who just completed her first year of middle school (grade six). Based on information provided in her school cumulative file, CV attended a public school centered around Math and Science for elementary grades. In sixth grade she began attending St. Margaret Mary School in a suburb directly outside of the large urban city in which she lives. St. Margaret Mary enrolls students in grades K4 through 8. Eighty percent of the student body qualifies for free or reduced priced lunch. Seventy percent of the students are Black, 21% are White, 3% are Asian, and 3% are Hispanic (GreatSchools.Org).

According to CV's mother she was assessed for Special Education services in early elementary school due to concerns regarding her academic achievement primarily in reading comprehension and fluency. CV did not qualify under any Special Education categories. As an

alternative, CV began attending Cardinal Stritch's City Center literacy program in third grade (age 8). The program provides CV with individualized tutoring sessions twice a week for two hours. Her initial sessions focused on improving reading comprehension; however, her tutor noted that CV had difficulty finding the right words to express her thoughts orally and in writing, along with difficulty pronouncing many multisyllabic words.

CV was given a number of informal and formal assessments December 2012 to determine the strengths and areas of need in her reading and writing abilities. Assessments used include the Qualitative Reading Inventory (QRI)-5 (Leslie & Caldwell, 2011), Woodcock Reading Mastery Tests-R (Woodcock, 1987), and the Woodcock Reading Mastery Test III (Woodcock, 2011).

CV's scores on the sixth grade word list from the QRI-5 fell within the independent range. She scored in the frustration range on the Upper Middle School word list. While reading QRI-5 passages, CV made errors such as letter insertions, omissions, substitutions, and reversals. She did self-correct at times while reading during the QRI-5. On the Woodcock Reading Mastery Tests-III, her standard score on the word identification test indicated a standard score of 92 which would be in the average range. On the Word Attack section of the Woodcock Reading Mastery Tests-III, CV scored on the high end of average with a standard score of 112. On the vocabulary section of the same test, CV scored a standard score of 84 which was on the very low end of average. With regard to fluency, CV read a QRI-5 upper middle school passage at a rate of 115 WPM. Her fluency was also assessed using the Oral Reading Fluency test of the Woodcock Reading Mastery Tests-R. Her standard score of 94 was considered average.

In the area of reading comprehension which pertains specifically to this study, CV scored in the instructional range when reading a grade 6 passage on the QRI-5. She answered 6 of 8 comprehension questions correctly. On the Woodcock Reading Mastery Tests-III Passage Comprehension section, CV had a standard score of 93 which would fall under the average range. However, the grade equivalent score would be a 4.2 to 5.4 reading level, which was a full year behind her grade level. For this reason, I chose to use reading comprehension as one of the areas of focus in CV's intervention in this study.

Description of Procedures

To address CV's needs in the area of reading comprehension as well as investigate my interest in the area of Math word problem comprehension, an intervention was designed and implemented in order to see if teaching and practicing various comprehension strategies would transfer over to performance in solving math word problems. The intervention was implemented in a one to one setting during the summer. Sessions were held twice a week for 1-2 hours, and there were a total of 14 sessions. Assessments were conducted during the first and last sessions. Thus, the designed intervention was implemented for a total of 12 sessions.

The first session began with general discussion and then a survey regarding CV's feelings towards reading and math word problems. CV was then assessed using the QRI-5 (Leslie & Caldwell, 2011) and Key Math 3 (Connolly, 2007) in order to gain baseline data with regard to her reading comprehension levels and math problem solving skills.

Excluding the first, second, and last sessions, the intervention sessions followed a consistent routine. CV selected a book on her reading level and of interest to her. She chose,

Nancy Drew: A Race Against Time (Keene, 2004) as she enjoys reading mysteries. At the beginning of every session CV would read a pre-designated amount of the book, approximately a half of chapter. The reading would alternate between reading aloud and reading silently. I would then ask CV 5 comprehension questions that I developed. The questions were a mix of explicit and inferential questions. CV was then given 3-6 math word problem to complete. All problems were at about a sixth grade level. Each week a different math concept was covered in order to prevent improvement coming from repeated exposure to the content. The math content used was also changed every session to prevent questions coming solely from an area of weakness or strength for CV. In addition, CV received unlimited time when answering all comprehension and math word problems.

CV would then be taught a reading comprehension strategy. The strategies were all researched based and chosen based on various factors such as time consumption and flexibility. Next CV would read the second half of the chapter from the Nancy Drew book. She would use the comprehension strategy she just learned while answering 5 more comprehension questions developed by the researcher based on what she read. Finally, CV would be given 4-6 more math word problems containing the same concept used for the first set of problems earlier in the session. This time however, CV would be encouraged and guided to use the newly learned comprehension strategy to aid her in completing the math word problems.

Session One. As mentioned above, session one began with CV and I getting to know each other. We spent approximately 5 minutes talking generally about our backgrounds and what the sessions would consist of. CV then had the opportunity to ask any questions she had. I then proceeded to give CV the QRI. Based on previous QRI results I had CV begin by reading the

second grade word list. She was able to score in the independent range until she reached the upper middle school list where she scored in the instructional range. CV was asked the story background questions and then read the level six (independent range) passage entitled "Abraham Lincoln". Following the story she answered the designated comprehension questions. At this point CV took a short bathroom break and we ended the session with CV completing a survey I created to evaluate her feelings towards reading and math word problems.

Session Two. The second session consisted of CV taking the Key Math 3 Diagnostic Assessment (Connolly, 2007). She only completed the following relevant sections of the assessment: Numeration, Mental Computation and Estimation, Addition and Subtraction, and Multiplication and Division. CV took a short break at this time and then completed the Foundations of Problem Solving, and Applied Problem Solving sections.

Session Three. This session began with CV reading chapter one of her chosen 6th grade level text: *Nancy Drew: A Race Against Time.* She was then asked verbally five comprehension questions regarding events and characters from the first chapter. She wrote her response to all five questions. No hints or clarification was provided. CV then answered six grade level math word problems involving the use of division. Again, no hints or clarification was provided. CV took a bathroom break at this time and then was introduced to her first reading comprehension strategy: pre-teaching vocabulary (Beck et al., 2008). The concept of the strategy was discussed with CV. The implementation of the strategy consisted of CV and the researcher going through Chapter 2 together to look for unfamiliar vocabulary. Any words CV found unfamiliar were defined and discussed until she fully understood their meanings.

CV then completed another six of the division math word problems using the pre-teaching vocabulary comprehension strategy. The researcher ensured CV understood every word mentioned in the problems (Beck et al., 2008). Any words that were unknown or unclear were defined or clarified before CV began solving the word problems.

Session Four. At the end of session three, CV stated that reading two chapters a session was too much for her. Thus beginning session four, CV read half a chapter at a time. This session she read half of chapter 3 aloud and then answered five comprehension questions. The researcher then introduced the next comprehension strategy to CV, which was story retelling/paraphrasing. The concept of the strategy was discussed and clarified with CV. CV read aloud the remainder of the third chapter. Immediately following CV's reading she retold/paraphrased what she had just read (Rinehart et al., 1986). CV was then asked five comprehension questions and provided a written response. The session concluded with the researcher and CV taking turns reading aloud for the following two chapters.

Session Five. The session began with CV completing 6 math word problems from a math story. The problems were critical thinking addition/subtraction/multiplication/division problems. CV answered the problems independently. CV then used the "story retelling" strategy to answer the questions again. CV retold everything she remembered from the story and then completed the math word problems again. CV took a short bathroom break at this time.

CV read half of chapter 6 and then answered five comprehension questions. CV was then taught a new comprehension strategy. She was introduced to using a main idea map. We discussed the purpose of the maps and when they would be used (Berkowitz, 1986). CV then

read the second half of chapter 6 and completed a main idea map on that section. She then answered five more comprehension questions. All of CV's responses during this session were written. We continued the session with the math word problems. There were six basic math operation/critical thinking problems in total. CV completed the first three with no assistance. She then created a main idea map for the last three problems before answering them. The session concluded with the researcher reading the next chapter aloud to CV.

Session Six. The session began with CV reading aloud the first half of Chapter 8 in her chosen book we've been using for the study: *Nancy Drew: A Race Against Time.* She answered five comprehension questions with no assistance. She was then taught another comprehension strategy: student generated questions (Paris et al., 1991). This strategy was discussed and explained to CV. She then read the second half of the chapter and generated her own comprehension questions. CV then answered five more comprehension questions regarding the second half of the chapter read. CV's responses to all comprehension questions were written for this session. We continued the session with CV answering three math word problems regarding the use of bar and line graphs. She answered these questions with no assistance. She then read through another three similar math word problems. This time CV used the "student generated questions" strategy with the math word problems. For each question, she thought of a question that would assess a student's understanding of what was being asked in the word problem. She then completed the word problems she generated questions for independently.

Session Seven. The session began as usual with CV reading the first half of chapter nine in her chosen book. This time she decided to read silently rather than aloud, however. She answered five comprehension questions regarding the first half of the chapter. CV was then

taught another comprehension strategy. The strategy was "pre-reading" text. We discussed what it meant to "pre-read" (Vacca, J., & Vacca, R., 1996). CV explained how she didn't think she would like this strategy and I replied, "We'll just give it a try today and if you don't like it you will not have to use it again". She then pre-read the second half of the chapter aloud. Pre-reading consists of reading quickly before actually reading for comprehension. CV then read the second half of the chapter silently before answering five more comprehension questions on what she had just "pre-read" and then read again. The comprehension questions were answered verbally by CV and recorded by the researcher.

After a bathroom break the session continued with CV answering three math word problems regarding the use of circle graphs. She answered the first three questions with no assistance as usual. She then pre-read each of the three circle graphs questions before reading them again and answering them.

Session Eight. This session began with CV reading aloud the first half of chapter ten. She then answered five comprehension questions with no assistance as usual. A new comprehension strategy was then taught to CV. She learned the "prediction" strategy which involves predicting what will happen next in a text (Duke, & Pearson, 2002). CV proceeded to predict what would happen next in the story. She stated her predictions aloud and then read the second half of chapter ten. She then answered five more comprehension questions regarding what she just read. The comprehension questions were answered verbally by CV and recorded by the researcher. CV was so interested in the book she asked if we could read the next chapter aloud together before completing the math word problems for the day. Thus, the researcher and CV took turns reading Chapter Eleven aloud until the end of the session.

Session Nine. We began the session with the researcher finishing reading Chapter Eleven aloud. CV then completed math word problems regarding fractions and percent. She completed the first three problems with no assistance, and then used the prediction comprehension strategy before completing the last three problems. CV was read the beginning informative part of each question and then asked to predict what the question would ask.

Following a short break, CV read the first half of Chapter Twelve aloud and answered five comprehension questions with no assistance. She was then taught a new comprehension strategy: comprehension monitoring. Comprehension monitoring requires that the reader take a step back after reading and ask themselves whether they understood what they just read. The reader asks herself what was misunderstood (Pressley, et al. 1998). The strategy was discussed with CV and she then read the second half of Chapter Twelve aloud. After reading CV determined what she thought she didn't fully understand. While discussing what she misunderstood, she was guided towards understanding the text. CV then answered five comprehension questions regarding the second half of Chapter Twelve. Answers to the comprehension questions were answered verbally by CV and recorded by the researcher.

Session Ten. The session began with CV completing math word problems. The word problems were regarding making predictions when looking at line graphs. She completed the first three problems with no assistance. The researcher then reviewed the strategy taught at the last session, "comprehension monitoring" (Pressley, et al. 1998). CV then read each question and discussed her comprehension of what the question was asking with the researcher. After this discussion she would answer each question.

After a short break CV and the researcher then had a discussion summarizing the various comprehension strategies used throughout the intervention sessions. The researcher asked which strategies taught stood out or were the most memorable to CV. She was also asked which strategies she could see herself using in the future. The session concluded with CV and I taking turns reading aloud chapter 13 of *Nancy Drew: A Race Against Time*.

Session Eleven. This session began with CV and the researcher taking turns reading aloud the final chapter of *Nancy Drew: A Race Against Time.* The ending of the book was discussed and then a short break was taken. CV was then given the level six QRI again. The story used for the QRI was expository and entitled, "Temperature and Humidity".

Session Twelve. The final session consisted of CV completing the Key Math 3 Diagnostic Assessment again. Due to a time shortage and researcher determined lack of necessity, only the "Foundations of Problem Solving", and "Applied Problem Solving" sections were assessed. The session ended with general conversation about the intervention study and what CV thought about the whole process.

Explanation of Data Collection

To measure the effectiveness of the intervention outlined above, data were collected using various methods including, an informal survey assessing the subjects feelings towards reading and math word problems, Qualitative Reading Inventory-5, Key Math Diagnostic Assessment 3, informal researcher developed comprehension assessments, informal researcher developed/chosen math word problems assessments, and informal surveys regarding subjects feelings towards the various math topics assessed throughout the study.

General Survey. The first piece of data collected was a general survey regarding CV's feelings towards mathematics word problems and reading in general. This was given in order to evaluate whether negative feelings would have an impact on the study's outcome.

Qualitative Reading Inventory-5. The Qualitative Reading Inventory-5 (QRI-5) was used as a pre-test and post-test to measure the overall effect on the subjects comprehensive reading comprehension performance (Qualitative Reading Inventory-5; Leslie & Caldwell, 2011). The QRI-5 provided specific measure of CV's abilities in the areas of word identification, accuracy, reading rate, and comprehension. To measure word identification, the subject read lists of words organized by levels. The student then *orally* read a passage while the researcher recorded miscues to evaluate accuracy, and time elapsed to determine the subjects reading rate. Finally, there were explicit and implicit questions following the passages read in order to measure the subject's comprehension of the passage.

Key Math Diagnostic Assessment 3. The Key Math Diagnostic Assessment 3 (Connolly, 2007) was given to CV as a pre and posttest to evaluate her general abilities in mathematics, as well as her abilities to problem solve. The following specific areas were evaluated: Numeration, Mental Computation and Estimation, Addition and Subtraction, Multiplication and Division, Foundations of Problem Solving, and Applied Problem Solving. The assessment consisted of the researcher reading various problems to the student. The problems were presented with pictures and in easel form to the subject. CV answered the majority of problems verbally; however, some problems were completed on paper.

Informal Comprehension Assessments. CV was given two informal reading comprehension assessments almost every intervention session. The assessments each consisted of five comprehension questions containing equally explicit and implicit questions. The questions were generated by the researcher. The assessments were given before and after a comprehension strategy was taught. CV responded verbally for half of the assessments and with a written response for the other half of the assessments. All questions were weighted equally. There was one point given for a partially correct answer, and two points given for a fully correct answer. The assessments were graded and given a percentage score in order to monitor improvement.

Informal Math Word Problem Assessments. Similar to the informal reading assessments, CV was given two informal math word problem assessments almost every intervention session. The assessments were very informal and usually just three questions regarding a math concept on approximately the sixth grade level. The questions were generated from various sixth grade math resources found online. Each question was worth two points. One point for a partially correct answer, and two points for a fully correct answer. The assessments were graded and given a percentage score in order to gauge improvement.

Informal Survey Regarding Subjects Feelings towards Math Word Problems. Before each informal math assessment was given, CV's background and feelings towards the math concept being assessed was surveyed. The researcher would ask the following questions: "have you worked with _____ before?", "how confident do you feel with this topic?" These questions were asked before any new math topic was presented to CV.

Conclusion

Parent input, previous assessments, and historical data indicated that CV, a middle school student, would benefit from an intervention aimed to improve her overall reading comprehension skills. The intervention procedures outlined in this chapter were based on research and designed to meet CV's needs. CV's progress was constantly assessed throughout the study using informal assessments developed by the researcher along with formal assessments including the QRI-5 and Key Math 3 Diagnostic Assessment. The following chapter will discuss the results from the data collected.

CHAPTER 4

Results

The purpose of this study was to investigate the effects of a reading comprehension intervention on comprehensive reading comprehension performance to determine whether the skills gained in the intervention would affect the subject's math word problem performance success. The intervention procedures outlined generally what took place in the intervention study, along with details of what took place in each individual session. In this chapter, data collected from surveys/assessments administered before, during, and after the intervention are presented and analyzed.

Pre-Intervention Data

Subject Attitude/Feelings Survey. The first set of data collected from CV was a "feelings towards reading and math word problems" survey. This survey was given during session one to grasp whether interest or lack of interest in reading or math word problems would play a role in CV's effort and thus overall performance throughout the study. The results of the survey are shown in the table 4.1.

Table 4.1: Pre-Intervention Survey on Subject's Feelings towards Reading/Math Word Problems

Survey Question	CV's Response
Do you like to read?	"Kind of"
Do you consider yourself a good reader?	"Yes"
When you are reading do you feel like you understand what you are reading?	"Yes but it all depends on the book"
What is hard about reading?	"Sometimes it might be hard words that you don't know"
Do you like math?	"Well yes and no"
Do you consider yourself a person that is good at math?	"Kind of not that much"
Are you good at completing math word problems?	"Well I really don't know, maybe"
What is hard about math word problems?	"The big numbers that you don't think is real"

CV did not display a strong dislike towards math or reading. This was great, as I did not want a general dislike for reading or math to skew the data collected in the study. The answers shown in the table were written responses provided by CV; however, through conversation, clarification on unclear responses were given. One question on the survey asked, "When you are reading do you feel like you understand what you are reading?" CV clarified her response of "depends on the book", by expressing that she understood books that were of interest to her, and that history books and "thick books with small print" were usually hard for her to understand. Another question asked, "Are you good at completing math word problems?" CV genuinely didn't know if she was good at completing math word problems. She did state that, "when there is too much information I get really confused". Overall, the pre-intervention survey and conversation generated with CV from the survey, allowed the researcher to see that CV

was interested in learning and open to growing in her reading comprehension and math word problem abilities.

       Pre-Intervention Results of the QRI-5. According to the authors of the assessment, the *Qualitative Reading Inventory-5* (*QRI-5*) is an individually administered informal reading inventory (IRI) designed to provide information about (1) conditions under which students can identify words and comprehend text successfully, and (2) conditions that appear to result in unsuccessful word identification or comprehension (QRI-5; Leslie & Caldwell, 2011). To establish overall reading ability, accuracy, and comprehension prior to the intervention, the QRI-5 was administered during the first session.

       Based off recent QRI-5 results obtained from CV's cumulative file, CV began the *QRI-5* by reading the words from the level two list. She identified 95% of the words accurately and automatically[1]. A score of 95% is considered to be at the "independent level". CV then read words from the level three word list and again identified 95% of the words accurately and automatically, scoring in the "independent level". She continued by reading the level four and five lists. She identified 90% (level four) and 95% (level five) of the words accurately and automatically, again scoring in the "independent level".

       The next word list read by CV was level six. She identified 85% of the words accurately and automatically, this time placing her at the "instructional level" for level six. The upper middle school level was the final list read by CV. She was able to identify 70% of the words

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[1] **Automatic:** identifying a word correctly within 1 second (Leslie & Caldwell, 2011)

accurately and automatically. A score of 70% was at the very low end of the "instructional level". Table 4.2 illustrates the results of the word identification part of the *QRI-5* assessment.

Table 4.2: Pre-Intervention Results of the QRI-5 Word Identification

Word List Level	Percent Total Correct Automatic	Total Correct Overall	Level
Second	95%	95%	Independent
Third	95%	95%	Independent
Fourth	90%	90%	Independent
Fifth	95%	100%	Independent
Sixth	85%	85%	Instructional
Upper Middle School	70%	75%	Instructional

The word identification list provided a starting point for the narrative section of the *QRI-5*. CV read the level six narrative "Abraham Lincoln". Before reading the "Abraham Lincoln" selection CV completed the story background knowledge questions. Her background knowledge score was 50%, signifying she was unfamiliar with the topic of the reading selection which included Abraham Lincoln and his life (Leslie & Caldwell, 2011, p188). Essentially, CV was able to describe how Abraham Lincoln looked but knew little about his contributions to American History.

While reading the narrative, "Abraham Lincoln", CV had only 6 miscues[2] indicating that she was reading at the independent level in the area of accuracy for the level six passage.

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[2] **Miscue:** Mistakes while reading orally including: whole-word substitutions, such as "tried" for "trade"; non-word substitutions such as "trad" for "trade"; and omissions and insertions of words. (Leslie & Caldwelll, 2011, p. 55)

However, the results of the comprehension section of the *QRI-5* were unexpected. From the narrative, "Abraham Lincoln", CV was able to retell 24 of 47 events (51%) from the story. The assessment then called for CV to answer 8 comprehension questions, 4 that were implicit[3] and 4 that were explicit[4]. CV answered 2 out of 4 (50%) implicit questions correctly, and 3 out of 4 (75%) explicit questions correctly. Overall, she answered 5 out of 8 (63%) comprehension questions correctly, which indicate that the level six "Abraham Lincoln" narrative was at the frustration level for CV.

   CV's scores in the sections of the *QRI-5* were inconsistent as she scored in the instructional range (85%) for word identification, the independent range (98%) for reading accuracy, and the frustration range (63%), for comprehension. Therefore, according to the *QRI-5*, CV's instructional reading level would be lower than level six as her overall reading level would be considered at the frustration range based on her scores (Caldwell & Leslie, 2011). Due to time constraints and the borderline nature of CV's frustration level score for the level six passage, another passage was not read, and it was assumed that CV's reading level was just below level six. Table 4.3 summarizes the information regarding CV's results from the *QRI-5* Pre-Intervention.

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[3] **Implicit:** Answers in which the reader must infer using clues in the passage (Caldwell & Leslie, 2011)
[4] **Explicit:** Answers stated directly in the text (Caldwell & Leslie, 2011)

Table 4.3: QRI-5 Pre-Intervention Results

QRI-5 Measure	Results	Comments
Level	Level Six	
Title	*Abraham Lincoln* (Narrative)	
Background Knowledge	50% (Unfamiliar)	CV could describe Abraham Lincoln physically and knew he had something to do with helping African Americans.
Accuracy	98% (Independent)	6 miscues (3 omissions and 3 whole word substitutions)
Rate	118 WPM 116 CWPM	Average reading rate for level six is 150 CWPM
Retelling Task	24 events recalled (51%)	
Explicit Comprehension	75%	
Implicit Comprehension	50%	
Overall Comprehension	63%	Frustration/Instructional Level

Key Math 3 Diagnostic Assessment Pre-Intervention Results

In order to gain baseline data on CV's general math computational and operational

abilities, along with her math problem solving abilities, the *KeyMath-3 Diagnostic Assessment*

(Connolly, 2007) was given to CV during the second intervention session. The *KeyMath-3*

Diagnostic Assessment (KeyMath-3 DA) is a comprehensive, norm-referenced measure of

essential mathematical concepts and skills. The *KeyMath-3 DA* is untimed and individually

administered. It is designed to provide accurate diagnostic information that practitioners can

use to develop effective and individually tailored intervention programs (*KeyMath-3 Diagnostic Assessment*; Connolly, 2007).

Due to time limitations, only subtests relevant to the study were given to CV. Therefore, there are only scores for the various subtests taken, and no "total test score". The following subtests were given to CV: Numeration, Mental Computation and Estimation, Addition and Subtraction, Multiplication and Division, Foundations of Problem Solving, and Applied Problem Solving. These tests encompass material covered up until sixth grade. The Algebra and Geometry subtests were omitted as they have not been an area of focus for CV in school up until this point. A description of the math subtests given to CV are shown in table 4.4.

Table 4.4: Description of KeyMath-3 DA Subtests (Connolly, 2007, p. 6)

Subtest Category	Description
Numeration	Measures an individual's understanding of whole and rational numbers. It covers topics such as identifying, representing, comparing, and rounding one-, two-, and three- digit numbers as well as fractions, decimal values, and percentages.
Mental Computation and Estimation	Measures an individual's ability to mentally compute answers to given math problems using addition, subtraction, multiplication, and division operations. It covers problems involving one-, two-, and three- digit numbers, fractions, decimals, and percentages. Emphasis is placed on ability to quickly determine a correct answer or approximation.
Addition and Subtraction	Focuses on written algorithmic procedures and concepts. It measures an individual's ability to add and subtract whole and rational numbers, including two- and three- digit numbers, fractions, mixed numbers, decimal values, and integers. It also measures ability to solve/simplify algebraic expressions involving addition and subtraction.
Multiplication and Division	Focuses on written algorithmic procedures and concepts. Measures ability to multiply and divide using one- and two- digits with whole and rational numbers, including fractions, decimal values, and integers. Also measures ability to solve/simplify algebraic expressions involving multiplication and division.
Foundations of Problem Solving	Assesses "readiness" for applied problem solving. It measures ability to identify the necessary elements, operations, and strategies required to solve math problems. Emphasis is on ability to explore the procedural elements that facilitate solutions.
Applied Problem Solving	Measures an individual's ability to interpret problems set in a context and to apply computational skills and conceptual knowledge to produce a solution. This subtest allows use of paper and calculators.

CV's scores from the various subtests ranged in grade level equivalents from 3.0 to 5.2.

Her highest score of grade equivalent 5.2 was in the area of "Addition and Subtraction", which

was expected as CV was not far removed from elementary school where there is a great

emphasis on addition and subtraction algorithms. Her grade level equivalent score of 3.0 in the

area of "Applied Problem Solving" was her lowest area of performance.

The two subtest areas most relevant to the math portion of the study include "Applied Problem Solving", and "Foundations of Problem Solving", as they relate closest to a student's success with math word problems. The researcher predicted these two subtest areas in particular would improve based on the intervention conducted in the study. While the *KeyMath-3 DA* was being administered, CV was initially enthusiastic and very cooperative. As the test continued, CV seemed to begin to lose interest. CV's results from the *KeyMath-3 DA* subtests described above are shown in table 4.5.

Table 4.5: Pre-Intervention *KeyMath-3 Diagnostic Assessment* Results

Subtest/Area	Grade Equivalent	Age Equivalent
Numeration	4.1	9:7
Mental Computation and Estimation	5.0	10:7
Addition and Subtraction	5.2	10:7
Multiplication and Division	4.9	10:4
Foundations of Problem Solving	3.8	9:5
Applied Problem Solving	3.0	8:5

Informal Assessment Intervention Data

     Informal Comprehension Assessments. CV was given two informal reading

comprehension assessments at almost every intervention session. The assessments each

consisted of five comprehension questions containing equally explicit and implicit questions.

The questions were generated by the researcher. The assessments were given before and after

a comprehension strategy was taught. The subject read different passages before and after the

strategy was taught to prevent the benefits of re-reading affecting her scores. CV responded verbally for half of the assessments and with a written response for the other half of the assessments. All questions were weighted equally. There was one point given for a partially correct answer, and two points given for a fully correct answer. The assessments were graded and given a percentage score in order to gauge improvement. The results of the informal comprehension assessments given throughout the intervention sessions are shown in Table 4.6 and Chart 4.7.

Table 4.6: Informal Reading Comprehension Assessment Results

Comprehension Strategy Taught	Score *Without* Strategy (Percentage)	Score *With* Strategy (Percentage)	Comments
Pre-Teach Vocabulary	60%	60%	CV stated she liked this strategy but has never used it before
Story Re-telling	70%	80%	CV stated she had used this strategy before
Main Idea Map	90%	60%	CV stated she had used this strategy before
Student Generated Questions	60%	90%	CV seemed to struggle to come up with questions. She was prompted w/ examples. She stated she had not used this strategy before.
Pre-Reading	90%	100%	CV did not like this strategy and thought it was "stupid to read something twice". She had used it before.
Prediction	90%	100%	CV used this strategy before.
Comprehension Monitoring	70%	100%	CV had not used this strategy before.
Scores Averaged	**76%**	**84%**	

Chart 4.7: Informal Reading Comprehension Assessment Results
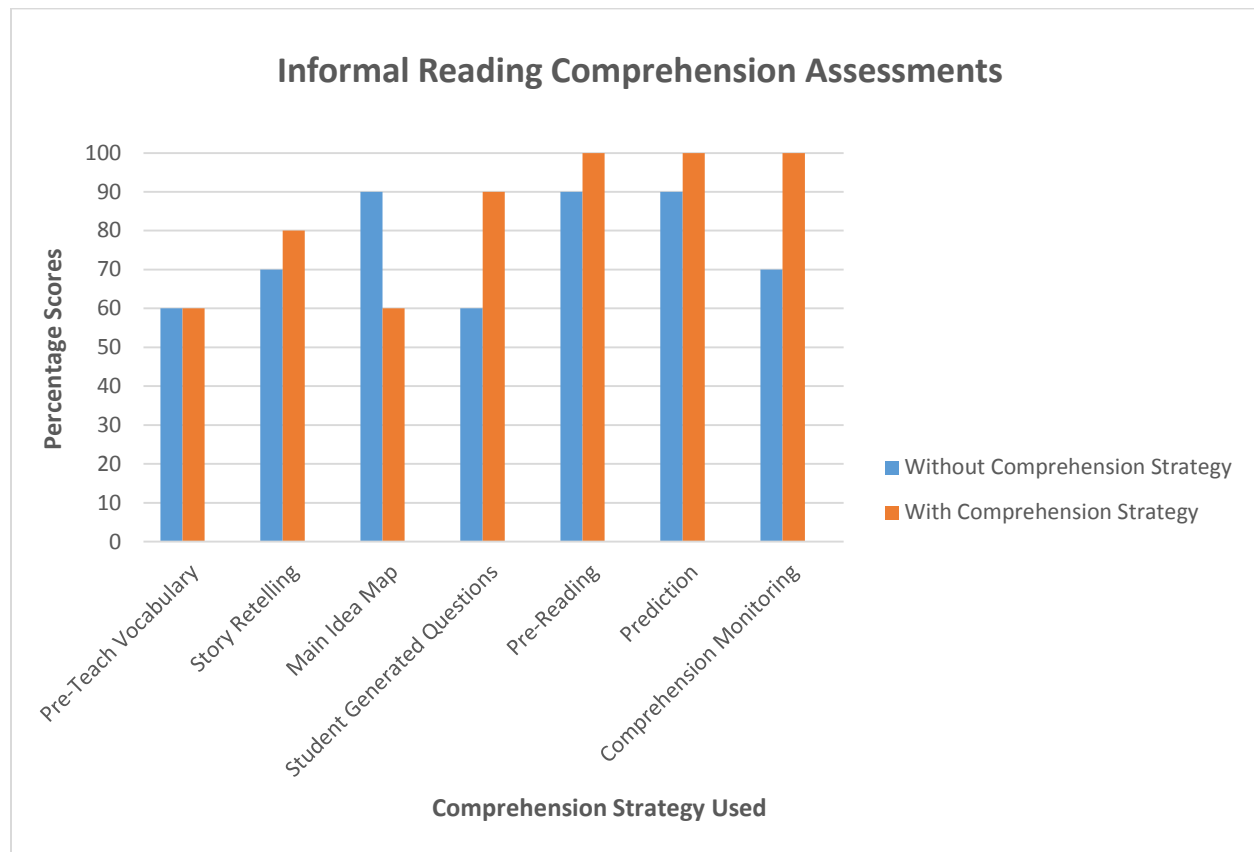
As shown in chart 4.7 displays, CV scored higher on the informal comprehension assessments following the use of a comprehension strategy on 6 out of 7 occasions. The only strategy used that did not produce a higher comprehension assessment score was the "main idea map". CV scored 90% before using the "main idea map" and only 60%, following the use of the "main idea map". In addition, CV's implementation of the "pre-teach vocabulary" strategy did not result in a higher informal comprehension assessment score.

However, on average, CV's informal reading comprehension score was 76% before using a comprehension strategy and 84% after using a comprehension strategy—an overall increase of 8 percentage points with the use of comprehension strategies. Her highest increase of 30

percentage points came with the use of "student-generated questions" and "comprehension monitoring", where she increased from 60% to 90% and 70% to 100% respectively.

Informal Math Word Problem Assessments. Similar to the informal reading assessments, CV was given two informal math word problem assessments almost every intervention session. The assessments were very informal and usually included just three questions regarding a math concept on approximately the sixth grade level. The questions were generated from various sixth grade math resources found online. Each question was worth two points. One point was awarded for a partially correct answer, and two points were awarded for a fully correct answer. The assessments were graded and given a percentage score in order to gauge improvement. The results of the informal math word problem assessments given throughout the intervention sessions are shown in Table 4.7 and Chart 4.8.

Table 4.7: Informal Math Word Problem Assessment Results

Comprehension Strategy Taught	Math Concept/Area	Score *Without* Strategy (Percentage)	Score *With* Strategy (Percentage)	CV's Comments
Pre-Teach Vocabulary	Division	17%	0%	Stated she felt "good" with regard to her "division" abilities
Story Re-telling	Addition/Subtraction Math Story	17%	33%	Stated the "math story" was, "so easy, too easy"
Main Idea Map	Math Operations Critical Thinking	0%	67%	Stated she felt "good" with regard to her "critical thinking" abilities
Student Generated Questions	Bar and Line Graphs	50%	83%	Stated she was, "good with them, going to be awesome, I think I'm awesome" When asked about her abilities with bar and line graphs
Pre-Reading	Circle Graphs	67%	100%	Stated she was, "awesome at circle graphs"
Prediction	Percent and Fractions	33%	33%	Stated, "I am good but getting to awesome with percent and fractions"
Comprehension Monitoring	Predicting Line Graphs	67%	83%	Stated, "easy, too easy" when asked about her ability to make predictions when looking at line graphs
Scores Averaged		**36%**	**57%**	

Chart 4.8: Informal Math Word Problem Assessment Results
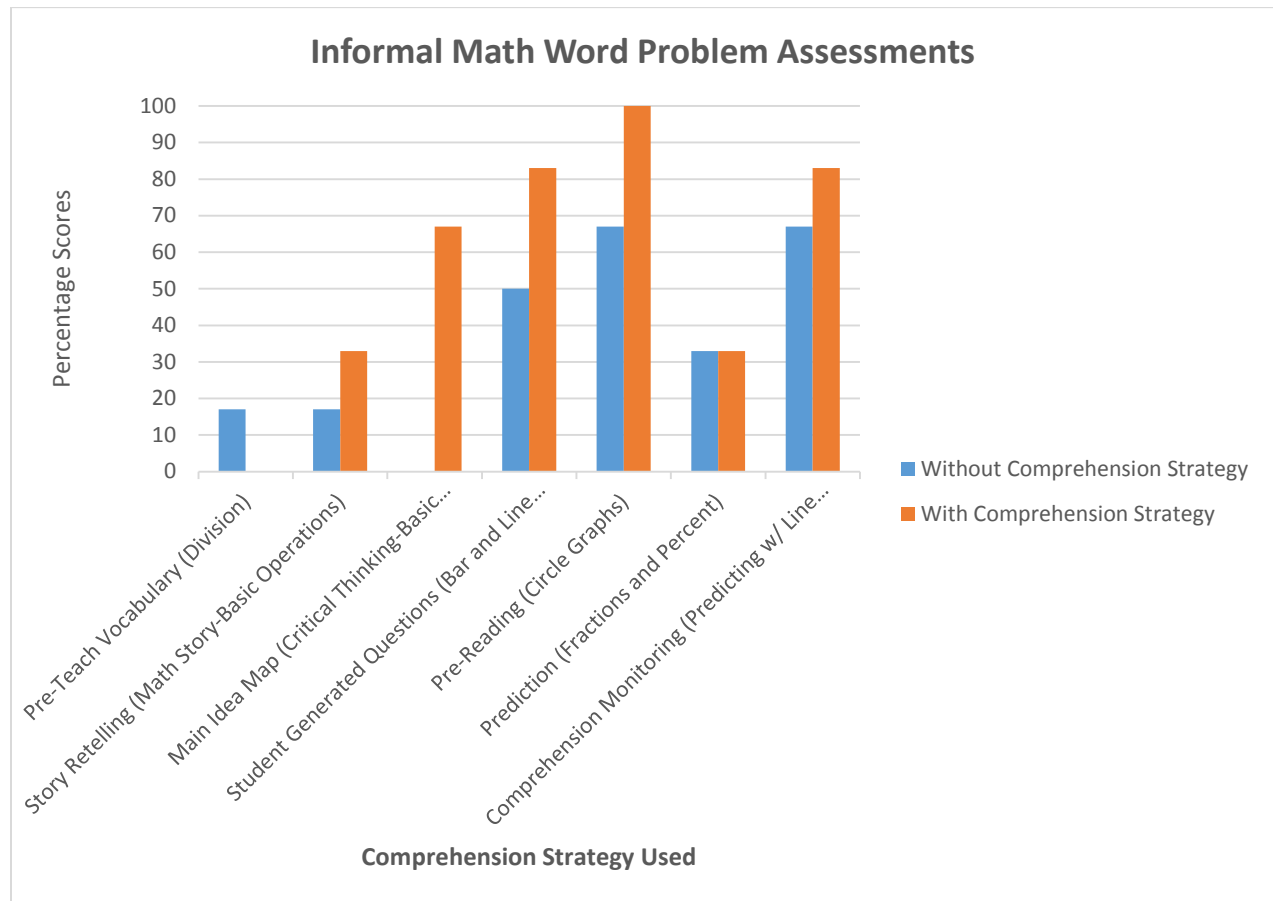
As shown in table 4.7 and chart 4.8, CV scored higher with the use of a comprehension strategy in 5 out of 7 times assessed. Her highest percentage increase came after creating a "Main Idea Map" to answer "Math Operations Critical Thinking" questions. CV scored 0% without the use of a comprehension strategy and then 67% with the use of the "Main Idea Map". CV scored lower with the use of a comprehension strategy on one occasion. When assessed in the area of "Division" with the use of the "Pre-Teaching Vocabulary" strategy, CV scored 17% without the use of the strategy and 0% with the use of the strategy. During another session where "Percent and Fractions" were assessed using the "Prediction" strategy, CV performed the same with and without the comprehension strategy.

Overall, the data implies that CV performed better on the math word problems when the reading comprehension strategies were used. On average CV scored a 36% without the use of comprehension strategies. With the use of the comprehension strategies she her average math word problem assessment score was 57%.

Post-Intervention Data

Post-Intervention Results of the QRI-5. To assess CV's overall reading ability, accuracy, and comprehension subsequent to the intervention, the *QRI-5* was administered during the second to last session. Claude began with the word identification lists. As Table 4.9 displays, CV performed at the independent range post-intervention for all word list levels assessed except "Upper Middle School" where she remained in the instructional range. However, CV did increase her "Total Correct Overall" score for all word list levels (except fifth as she was already at 100%).

Table 4.9: Results of the *QRI-5* Word Identification Pre-Intervention and Post-Intervention

Word List Level	Pre-Intervention Results			Post-Intervention Results		
	Percent Total Correct Automatic	Total Correct Overall	Level	Percent Total Correct Automatic	Total Correct Overall	Level
Second	95%	95%	Independent	100%	100%	Independent
Third	95%	95%	Independent	100%	100%	Independent
Fourth	90%	90%	Independent	90%	95%	Independent
Fifth	95%	100%	Independent	100%	100%	Independent
Sixth	85%	85%	Instructional	90%	95%	Independent
Upper Middle School	70%	75%	Instructional	75%	80%	Instructional

Following the word identification task, CV was assessed with the level six expository text, *Temperature and Humidity*. *As table 4.10 indicates, CV scored 17% on the prediction task, suggesting that she was unfamiliar with the topics included in the story (Caldwell & Leslie, 2011, p.* 185). CV read aloud *Temperature and Humidity* at a speed of 123 words per minute, however with 12 miscues, her correct words per minute were only 118. CV's combination of miscues and speed suggest she is at the instructional level in the area of accuracy for the level six text. From pre-intervention to post-intervention, her accuracy dropped from the independent range to the instructional range.

With regard to the comprehension section of the *QRI-5*, the post-intervention results indicate that CV was able to retell 18 out of 62 possible events from the *Temperature and*

Humidity text. This expository text included 8 comprehension questions, 4 explicit and 4 implicit. CV answered 4 out of 4 explicit questions correctly (100%) and 2 out of 4 (50%) implicit questions correctly. Although CV was less familiar with the post-intervention text topics, she had an overall improved average score of 75% in the area of comprehension questions.

Table 4.10: Results of the *QRI-5*, Pre-Intervention and Post-Intervention

QRI-5 Measure	Pre-Intervention Results		Post-Intervention Results	
	Results	**Comments**	**Results**	**Comments**
Level	Level Six		Level Six	
Title	*Abraham Lincoln* (Narrative)		*Temperature and Humidity* (Expository)	
Background Knowledge	50% (Unfamiliar)	CV could describe Abraham Lincoln physically and knew he had something to do with helping African Americans.	17% (Unfamiliar)	CV struggled to articulate her background knowledge. However, it seemed she knew more than she could verbally express.
Accuracy	98% (Independent)	6 miscues (3 omissions and 3 whole word substitutions)	96% (instructional)	12 miscues (6 omissions and 6 whole word substitutions)
Rate	118 WPM 116 CWPM	Average reading rate for level six is 150 CWPM	123 WPM 118 CWPM	Average reading rate for level six is 150 CWPM
Retelling Task	24 events recalled (51%)		18 events recalled (29%)	
Explicit Comprehension	75%		100%	
Implicit Comprehension	50%		50%	
Overall Comprehension	63%	Frustration/ Instructional Level	75%	Instructional Level

Post-Intervention Results of the KeyMath-3 Diagnostic Assessment. In order to gain comparative data on CV's math problem solving abilities following the intervention, the *KeyMath-3 Diagnostic Assessment* was again given to CV during the last intervention session. (*KeyMath-3 Diagnostic Assessment*; Connolly, 2007).

Due to time limitations, only subtests relevant to the study were given to CV. Therefore, there are only scores for the various subtests taken, and no "total test scores". The following subtests were given to CV in order to gain post-intervention data: Foundations of Problem Solving and Applied Problem Solving. A description of the math subtests given to CV are shown in table 4.4.

The two subtest areas most relevant to the math portion of the study include "Applied Problem Solving", and "Foundations of Problem Solving", as they relate closest to a student's success with math word problems. CV's performance increased on all areas of the *KeyMath-3 Diagnostic Assessment* that were assessed. Her "Foundations of Problem Solving" score increased from a grade equivalent of 3.8 to 5.0 which equates to a growth of 1 year and 3 months. Her age equivalent growth from 9:5 to 10:5 implied that she grew a whole year in the area of "Foundations of Problem Solving". In addition, CV's scores increased in the area of "Applied Problem Solving" from a grade equivalent of 3.0 to 5.0 (2 years growth) and age equivalent of 8.5 to 10.7 (2 years, 2 months growth). However, although significant growth was shown, CV still remains in the bottom 25th percentile when compared to her grade level peers nationally. Her standard score of 88 post intervention puts her at the 21st percentile when compared to her peers. Furthermore, CV did show tremendous growth, moving from the 7th percentile to the 21st, however, there is still a great need for improvement which will be

discussed further in the next chapter. CV's results from the *KeyMath-3 DA* post-intervention

assessment described are shown in table 4.11.

Table 4.11: *KeyMath-3 Diagnostic Assessment* Results Pre-Intervention and Post Intervention

Subtest/Area	Pre-Intervention Results				Post-Intervention Results			
	Grade Equivalent	Age Equivalent	Standard Score	Percentile Rank	Grade Equivalent	Age Equivalent	Standard Score	Percentile Rank
Foundations of Problem Solving	3.8	9:5	78	7	5.0	10:5	88	21
Applied Problem Solving	3.0	8:5			5.0	10:7		

Conclusion

The purpose of this intervention was to improve CV's general reading comprehension

and math word problem performance by teaching her reading comprehension strategies. The

results from the formal and informal assessments discussed in this chapter show evidence of

growth in CV's reading comprehension and math word problem performance. CV did show

some consistent areas weakness from pre-intervention to post-intervention assessments

including performance on implicit comprehension questions. The next chapter provides

additional details and explanations regarding CV's assessment results, along with further

recommendations to continue to improve CV's success in the area of reading comprehension

and solving math word problems.

CHAPTER 5

Discussion

An intervention focused on improving reading comprehension and math word problem performance was designed and implemented based on the needs of CV, a sixth-grade girl. Based on academic delays, CV's mother had her tested for Special Education services during her early elementary years; however, she did not meet qualifications. Thus CV has participated in one-on-one academic tutoring at the Cardinal Stritch Literacy Center since fourth grade. In this chapter, the results of the intervention are analyzed and connected to existing research in the field, relevancy to the Common Core Standards are discussed, as well as the strengths and limitations of this study. The chapter concludes with recommendations for CV's future academic success in the areas of reading comprehension and math word problem completion.

Connections to Existing Research

Research indicates that a successful reader must acquire foundational skills in each of the main components of literacy which include phonemic awareness, phonics, fluency, vocabulary, and comprehension (Zorfass & Urbano, 2008). Struggling readers often struggle with one or more of these components early on, which, in turn, effects their reading ability long term. This study focused on CV, a student with a history of below average reading comprehension performance. Through tutoring she has been able to continuously improve in this area, however, it remained an area of weakness for her.

The results of the *QRI-5* (Leslie & Caldwell, 2011) administered during the study indicated that CV has the necessary foundational skills to be a successful reader. CV read accurately, scoring "independent" on the word identification list at a level six and

"instructional" at the upper middle school level. She also read the level six passages with 98% accuracy before the intervention and 96% accuracy after the intervention. Although her reading was fluent and clear, her rates of 118 and 123 WPM were considered slightly below average for her grade level (Leslie & Caldwell, 2011). However, her lowest scores were in the area of comprehension where she scored 63% and then 75% on the post-intervention QRI-5. With that information in consideration, the study done by Applegate and Modla (2009) found that a reader (such as CV) who appears to be successful because he or she reads relatively accurately and fluently may struggle to understand the meaning of the text they're reading so fluently. Applegate and Modla believe this puts students at risk for long-term reading failure. Thus, with CV, and every student, their comprehensive literacy skills must be addressed whether they are fluent readers or not.

McKeown, Beck, and Blake conducted a study in 2009 which relates to this research with CV, where they assessed whether a content or strategies approach to teaching reading comprehension would produce better results. The study involved six fifth grade teachers and their classrooms over the course of two years. The researchers predicted that if taught explicitly, students would have success with both the strategies and content approach of teaching comprehension. Their prediction was somewhat correct. Their results lead them to conclude that all the instructional approaches provided for adequate growth in the area of comprehension however, a small but consistent pattern of differences occurred that favored the content approach.

CV's intervention involved a combination of both content and strategy-based instruction. Since both methods have been proven successful, I decided to implement both. CV

was definitely focused on the content of the readings we used, since she was interested in the content and given general comprehension questions (content approach) to think about and answer every session. She was then taught a comprehension strategy the second half of every session (strategy approach). The strategies used with CV included four of the five strategies Mckeown, Beck, and Blake used in their study: summarizing, predicting, question generation, and comprehension monitoring (Mckeown, Beck, & Blake, 2009).

As mentioned above, comprehension monitoring was a strategy used during CV's intervention. Schurer conducted research on this very topic in his 2002 study. Schurer investigated using comprehension monitoring as a technique for mathematical problem solving. Comprehension monitoring is generally defined as the awareness and control of one understanding or lack of understanding. Schurer hypothesized that there will be a significant difference in performance on a mathematical problem solving final assessment given to students who are taught to use comprehension monitoring throughout the semester compared to those who are not. He predicts the students taught comprehension monitoring will greatly outperform the students who are not.

The results of the study support Schurer's hypothesis as the intervention groups both outscored the control group on the final assessment. The mean test score for the control group was 66, where the mean score of the comprehension monitoring group was an 81. These successful results led me to select comprehension monitoring as a strategy used during the interventions designed for CV. CV score's on the informal comprehension assessment went from 70% to 100% with the use of the comprehension monitoring strategy. Furthermore, CV seemed to genuinely understand the strategy and the purpose behind its use.

In her 1997 study, Mcintosh, a high school Algebra teacher working with students deemed struggling with math word problems used a method she called "Fading Instruction" to teach her students to complete math word problems independently. This method involved gradually releasing the responsibility of completing math word problems to her students. The method included the use of various strategies traditionally thought of as "reading teacher strategies" however, Mcintosh was able to see success in her classroom as 100% of her students were able to successfully complete a given word problem with this model by the end of the study. Mcintosh stated, "teachers in the mathematics classroom are not expected to be reading teachers, but it behooves us to draw on strategies that have been found beneficial by reading teachers" (Mcintosh, 1997, pg. 31). This essentially drew me to use two strategies she found successful: pre-teaching vocabulary and story re-telling. CV was able to improve her informal math word problem assessment score from 17% to 33% with the use of story re-telling however, with the use of pre-teaching vocabulary, her score decreased.

Connections to Common Core Standards

As mentioned in the first chapter, the Common Core Standards (adopted in Wisconsin in 2010) were designed to provide a consistent and clear understanding of what students are expected to learn by content area and grade level. Furthermore, these standards provide a common structure for all American teachers to use when designing instruction. In theory, the implementation of common standards allows teachers to not only know what content they should cover but exactly what a student should know before and after they enter their class. Essentially, the standards reflect the knowledge and skills that young people need for success in

college and careers after high school (www.corestandards.org). The intervention implemented in this study aligns with several Common Core Standards in the area of literacy.

A grade seven English Language Arts standard states, "By the end of the year, read and comprehend literature, including stories, dramas, and poems, in the grades 6–8 text complexity band proficiently, with scaffolding as needed at the high end of the range" (CCSS.ELA-Literacy.RL.7.10). This standard generally confirms the importance of comprehension while reading for any seventh grade student. The standard acknowledges that a student may read and comprehend within a grade level range. Although, CV was completing sixth grade, this study was designed to give her support and strategies to move towards reading and comprehending towards the end of the middle school range.

Another grade seven English Language Arts standard states, "Cite several pieces of textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text" (CCSS.ELA-Literacy.RL.7.1). This standard emphasizes that a seventh grade student should be able to not only comprehend texts explicitly, but make inferences as well. This study will address CV's ability to make inferences while reading through assessment and the various interventions.

Explanation of Results

CV was assessed at pre- and post- intervention using the QRI-5 (Leslie & Caldwell, 2011), Key Math 3 Diagnostic Assessment (Connolly, 2007), and informal comprehension and math word problem assessments. The QRI-5 assesses word identification, accuracy, rate, and comprehension. The Key Math 3 Diagnostic Assessment measures essential mathematical concepts and skills. The informal comprehension assessments were designed to gauge CV's level of understanding (comprehension) after reading a portion of her chosen text. Finally, the informal math word problem assessments were designed to gauge whether CV improved with the use of each comprehension strategy.

As mentioned under Results, CV improved her comprehension score on informal reading assessments on 6 out 7 occasions when using a comprehension strategy taught to her. The only strategy used that did not produce a higher comprehension assessment score was the "Main Idea Map". CV scored 90% before using the "main idea map" and only 60%, following the use of the "Main Idea Map". This unexpected result may have been due to the elements of the day we worked on using the "Main Idea Map". CV was more tired than usual this particular day. She did not seem very enthusiastic to be at the session and was somewhat rushing through the tasks. It does not appear the "Main Idea Map" was a poor strategy considering CV later dramatically increased her math word problem performance following the use of a "Main Idea Map".

There was evidence of overall growth in the area of reading comprehension pre- and post- *QRI-5* results. However, CV did score lower in the area of "story retelling" from the pre- to post- assessment. She scored 51% on the pre-intervention assessment and 29% on the post-

intervention assessment in this area. Her decrease in score may have been affected by her lack of background knowledge on the post-intervention assessment's text topic (Temperature and Humidity). CV scored 19% on the background knowledge section of the assessment where as she scored a 50% on the background knowledge section of the pre-intervention text (Abraham Lincoln). In addition, it was very evident she was more confident with the first text due to her familiarity with the topic.

On the comprehension question section of the *QRI-5* CV increased her overall score from 63% to 75%. Her explicit comprehension score improved from 75% to 100% and her implicit comprehension score remained the same at 50% pre- and post- intervention. Again, the lack of background knowledge may have affected CV's performance on the implicit comprehension question section. She generally did not have a good grasp of the topic, thus was unable to make those background knowledge connections in order to make inferences.

With regard to the informal math word problem portion of the test CV scored higher with the use of a comprehension strategy 5 out of 7 times when assessed. Her highest percentage increase came after creating a "Main Idea Map" to answer "Math Operations Critical Thinking" questions. CV scored 0% without the use of a comprehension strategy and then 67% with the use of the "Main Idea Map". CV scored lower with the use of a comprehension strategy on one occasion. When assessed in the area of "Division" with the use of the "Pre-Teaching Vocabulary" strategy, CV scored 17% without the use of the strategy and 0% with the use of the strategy. This decrease in performance may be attributed to a weakness with the topic of division. CV scored a grade equivalent of 4.9 when assessed on her multiplication and division abilities pre-intervention. However, it was noted that she struggled

routinely with the division while she performed moderately on the multiplication. Therefore, these results may not accurately reflect the benefits of using the strategy "Pre-Teaching Vocabulary".

CV was assessed post-intervention in both the "Foundations of Problem Solving" and "Applied Problem Solving" sections of the *Key Math-3.* She improved in both categories. In the area of "Foundations of Problem Solving" CV increased her grade equivalent score from 3.8 to 5.0 and age equivalent score from 9.5 to 10.5. In the area of "Applied Problem Solving" CV increased her grade equivalent score from 3.0 to 5.0 and age equivalent score from 8.5 to 10.7. The results were amazing and evidence the benefit of using comprehension strategies to complete math word problems. CV seemed to approach the word problems on the post-assessment differently. She took her time and seemed to think out the problems more. This was a reflection of what we did during the sessions: she was made to take her time and use strategies.

Strengths and Limitations

This study has several strengths and limitations. The procedures carried out in each intervention session were consistent. A strength of the study included the environment. Prior to the start of this intervention study CV had been attending the Literacy Center for the past three years, thus, she was very familiar and comfortable with the setting which put her at ease at the very beginning of our sessions. Another strength included CV's positive disposition toward reading and learning as evidenced in her pre-intervention survey. She genuinely enjoyed learning which made the sessions a delight and non-threatening for her. In addition,

the intervention followed a routine every day and thus CV knew exactly what to expect. This allowed for a laid back culture during the intervention. CV was never surprised or unfamiliar with what was going to take place during a session, which she seemed to like.

Limitations of the study included the small sample size, short time frame, use of several strategies, and the same text each session. CV was the only subject during this study, thus it's hard to say if these successes would be seen if the intervention was applied to other students. Essentially CV was an ideal student considering she enjoyed learning and was very cooperative. This is definitely not the case for all students, thus, a larger sample to include that variable and many others would have made the study more reliable. The sample took place in a very short period of time. There were only 14 1-2 hour sessions held with CV over a seven-week time period. Considering introductions and testing there were approximately only 12 hours actually spent implementing the intervention, which was not enough time to see the full potential of this intervention.

Another downside of this study included the number of strategies used. There were 7 different strategies used throughout the study. The thought behind this was to try as many strategies as possible to see which one would work the best; however, the constant change became overwhelming to the researcher and subject at times. There may have been a clearer picture painted of CV's abilities and the reliability of the strategies if only one or two strategies were used rather than 7. However, since a new strategy was used following every text section read, there were no improvements made based on familiarity or repeated use of a strategy.

Contrary to new strategies being used every text section read, the same text was used throughout the entire study. CV selected a book at the beginning of the intervention and a part of it was read each session and used to develop explicit and implicit comprehension questions used on the informal comprehension assessments. CV's results on the informal assessments may have been affected by her familiarity with the text. She was following the story plot and may have been better able to make inferences and answer general questions due to that. A more accurate depiction of her comprehension abilities may have been seen if excerpts from various sources were used instead.

Recommendations for Student

CV's current ability in the area of accuracy is appropriate for her age and grade level. However, the results of the intervention study designed and implemented with CV indicate that she can still use further instruction in the following areas: reading comprehension, foundations of problem solving, and applied problem solving.

As evidenced in Chapter Four, CV improved her overall performance with regard to reading comprehension; however, she was still only at an average of 75% on the post-test *QRI-5*. Thus CV needs to continue to work on her reading comprehension skills. CV should continue to read and use the comprehension strategies learned throughout the intervention. She should chose her top 2 or 3 strategies and use them when presented with a reading comprehension task.

Although CV improved her scores in the areas of Foundations of Problem Solving and Applied Problem Solving from a grade equivalent of 3.8 to 5.0 and 3.0 to 5.0 respectively, she is

still below average as her standard scores and percentages show. Her post-intervention

standard score in the areas of Application (Foundations of Problem Solving and Applied

Problem Solving) was a 88 which is 10 points higher than her pre-intervention score but still

only places her at the 21st percentile when compared to her grade level peers.

CV should continue to build up her math word problem solving skills by breaking down

problems with the use of comprehension strategies proven successful for her in this study. CV

was afforded her highest percentage increase came after creating a "Main Idea Map" to answer

"Math Operations Critical Thinking" questions. CV scored 0% without the use of a

comprehension strategy and then 67% with the use of the "Main Idea Map"; thus, I would

recommend CV use main idea maps when presented with math word problems. She should also

utilize the "pre-reading" strategy as she was able to perform at her overall highest level with

the use of that particular strategy. Essentially, as CV continues to work on math word problems

as she progresses through academia, she must break the problems down using a strategy in

order to increase her chances of success.

Conclusion

CV participated in an intervention which was developed specifically for her with a goal

of increasing her reading comprehension and math word problem solving abilities by teaching

her various reading comprehension strategies. The results from the formal and informal

assessments indicate there was great growth in CV's reading comprehension and math word

problem performance following implementation of the various strategies she was taught. CV

did show some consistent areas weakness from pre-intervention to post-intervention

assessments including performance on implicit comprehension questions.

While the intervention procedures were consistent and implemented with fidelity, the results of this study were affected by various limitations including the limited time frame of the study, the use of multiple strategies, and the use of the same book throughout the study. CV would benefit from further practice and implementation of the multiple strategies she learned throughout this study. There was not enough time to grasp the full capacity of what she was taught. Although CV proved to be successful with the intervention in this study, she could very well see even greater results with a longer study focused on just one or two of the strategies where she saw the most success.

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APPENDIX A

Survey given to CV prior to start of Intervention

Survey for Comprehension/Math Word Problem Research

1. Do you like to read? Kind of

2. Do you consider yourself a good reader?
   yes

3. When you are reading do you feel like you understand what you are reading?
   yes but it all depends on the book

4. What is hard about reading?
   Sometimes it might be hard words that you know.

5. Do you like math?
   well yes and no

6. Do you consider yourself a person that is good at math?
   Kind of not that much

7. Are you good at completing math word problems?
   Well I really don't know Maybe

8. What is hard about math word problems?
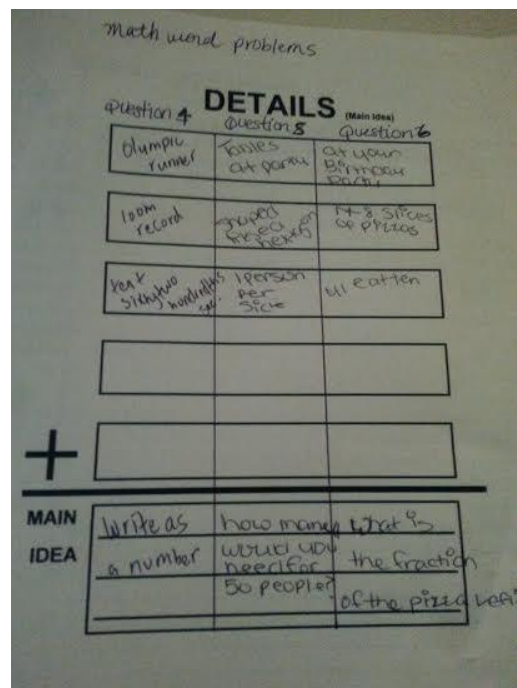   The big numbers. That you don't think is real

APPENDIX B

Example of Comprehension Strategy used by CV in Study: Main Idea Map

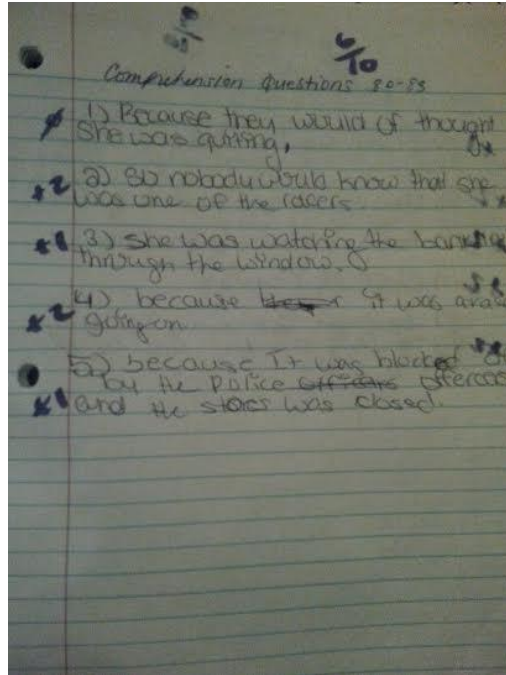Main Idea Map used for general reading comprehension
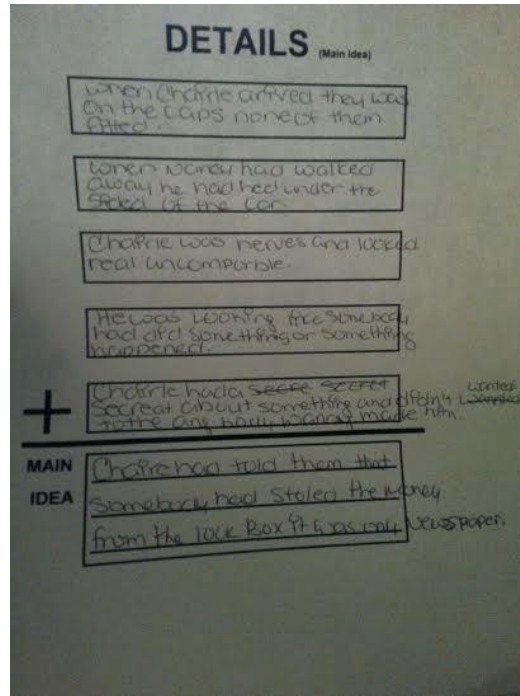
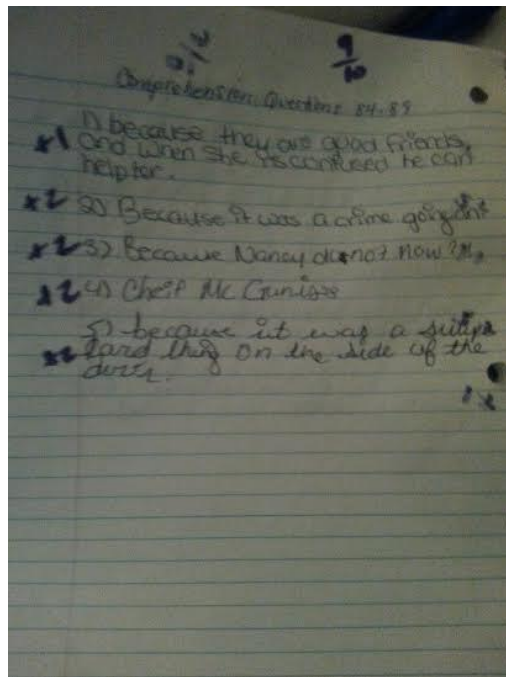Main Idea Map used for math word problem comprehension

APPENDIX C

CV's comprehension question performance before and after using a Main Idea Map

CV's performance on comprehension questions before using Main Idea Map

CV's performance on comprehension questions after using Main Idea Map

APPENDIX D

Example of math word problems used in this study

Name _____

Word Problems

1. I'm thinking of two numbers, 12 and another number. 12 and my other number have a greatest common factor of 6 and their least common multiple is 36. What's the other number I'm thinking of? 2

2. Tom had a platter of chocolate wafers. He ate 5 of them and then gave his brother 3, he then handed them to his ball team of 8 members. The first player to arrive took 1, the second player took 3, the third player took 5 and so on. When the last player took his, the platter was empty. How many chocolate wafers did Tom start with? 25

3. Jasmine has 50 marbles in a bag. 20% of the marbles are blue. How many marbles are blue? 25

4. An Olympic runner set a record for the 100m dash. The time was ten and sixty-two hundredths seconds. How would you write this as a number? 10,6200

5. The tables at the party are shaped like the hexagon. If you put the tables together, how many would you need for 50 people?)1 person per side.) 10 tables

6. At your birthday party, you had 7 8-slice pizzas. 41 slices were eaten. What fraction of pizza is left? 3/4 pizzas.

://math.about.com