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What Effect Do the Reading Comprehension Strategies of Text Coding and Journal Writing Have on the Reading Comprehension in the Mathematics Classroom of 9th Grade Students with Special Education Needs?

By

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A Graduate Field Experience

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For Darnell A. Hamilton
Has been approved for
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_____April 18, 2015_____

Date

Abstract

This study focused on improving the reading comprehension in the mathematics classroom of 9th grade special education students through the use of text coding and journal writing. This study was designed for nine students attending a newly opened public, urban Midwestern high school with a strong reputation in the gifted and talented community. The intervention was conducted over an eight week (two months), 25-minute sessions, occurring every other day at the end of the school day. Data measured the student's participation in intervention sessions and the overall success from session to session. All students demonstrated growth on their post-test assessments through the continued practice of the reading comprehension strategies of text coding and journal writing.

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Chapter 1

Introduction

Reading comprehension is an essential skill in developing deeper understanding of text. It is principally defined as a key application of knowledge in active reading. Mathematics texts are designed to guide and instruct students to explain what they have learned in the process of “doing” mathematics. Therefore, it is essential that the role of comprehension play a role in students’ active completion of strong mathematical understanding.

The use of comprehension in reading is a critical component for students to utilize when fully engaging with mathematics in a classroom that is rich with mathematical language (Adams & Lowery, 2007). It is in the classroom where students must connect learned mathematical concepts with the use of reading strategies. Achieving this will give students an advantage when performing mathematical activities such as solving word problems, computing/calculating, designing and interpreting graphs, responding to open-ended and multiple choice questions, and expressing the relationships between real-world situations and mathematical concepts (Adams & Lowery, 2007). Therefore, classroom mathematics teachers need to be aware that it is their responsibility to teach reading strategies so students are integrating literacy with mathematical understanding.

The purpose of this action research project is to determine the effects that text coding and journal writing have on a student’s reading comprehension level in ninth grade mathematics. This chapter gives background information of the study and how it will be conducted.

The purpose of the study is to examine the effect that the reading comprehension

strategies of text coding and journal writing have on the reading comprehension in mathematics of 9th grade students with special education needs. My hypothesis is that if the reading comprehension strategies of text coding and journal writing were taught successfully in a mathematics classroom for 9th grade students with special education needs, their mathematical language comprehension and classroom engagement would increase.

Chappell and Thompson (2007) suggest that the varied modes of communication (speaking, listening, writing, and reading) are integral to the development of mathematical literacy (Chappell & Thompson, 2007). It is essential that the different modes are integrated if students are expected to truly understand mathematics concepts. The focus of the study will examine how students use metacognitive strategies while reading mathematics content, and how students use journal writing as a form of recording their understanding of the mathematical process.

Because of this, it is a responsibility for teachers to invite students to enroll and participate in special interventions that are set up to foster positive mathematics-related beliefs (Corte, Masui, & Verschaffel, 2004). The study will implement a number of different literacy strategies to investigate if the use of them positively affects students' attitudes and academic standing in mathematics. Strategies that will be discussed include proper note taking in the form of journal entries during mathematics instruction and the effective use of coding strategies when reading mathematics text.

The study included the review of nine students who are enrolled as 9th graders at an urban high school in the city of Milwaukee, Wisconsin. All students met the criteria for receiving services identified under the Individuals with Disabilities Education Act

(IDEA). Under IDEA, students are entitled to a Free and Appropriate Public Education (FAPE) in their least restrictive environment (LRE). Legally, each student is entitled access to the general education curriculum; the students' LRE is their participation in the general education classroom. Each student meets the criteria for special education under a primary label that is specific to their needs.

Students participated in weekly interventions during school from 2:15pm to 2:45pm; students met with their mathematics intervention instructor every other day (on other days students met with their reading intervention instructor). The study's duration was from December 2014 through January 2015. Sessions were structured to include two six student groups, and designed to improve how students read mathematical text, and applied that knowledge to answering questions through their interpretation of the material. In accordance with IDEA, students participated full time academically in the general education environment. Students were guided to use the skills learned through intervention in the general education classroom. A brief description of each student is listed below:

A review of literature on reading comprehension in mathematics helped inform that the study should include practices that align with the Common Core State Standards (CCSS) of mathematics instruction. The mathematics intervention that students received aligned with the CCSS of high school Algebra. The first CCSS is "Seeing Structure in Expression (A-SSE)" (2015). The second CCSS is "Creating Equations (A-CED)" (2015). The third CCSS is "Reasoning with Equations and Inequalities (A-REI)" (2015).

In the next chapter, research will be presented as a review of articles and studies conducted by esteemed individuals in the field of education. The literature presented

supports the effectiveness of intervention in the mathematics classrooms for students who are in need of improving their reading comprehension skills.

Chapter 2

Review of Literature

When trying to determine the challenges that high school students display with comprehension of reading mathematical content material for school, it is essential to first define what reading comprehension is and how it relates to mathematics. The goal of reading comprehension involves the understanding of text and its context, by having the ability to apply knowledge to what was read (Adams & Lowery, 2007). In high school mathematics, texts are read by students “actively” in order to use the text to describe, explain, guide, instruct, and present the process of “doing” mathematics. Therefore, it is essential that the role of comprehension play a role in students’ active completion of strong mathematical understanding.

The purpose of this action research project is to determine the effects that text coding and journal writing have on a student’s reading comprehension level in ninth grade mathematics. This chapter summarizes a number of studies that address the essential discussion of why the use of reading and writing strategies need to be taught as supplementary guides for effective mathematical instruction. The chapter will focus on how educators around the world have incorporated reading and writing strategies into mathematics classrooms in order to improve upon student understanding of mathematical language. The first section focuses on defining the different reading strategies used in classrooms, of vocabulary and how it influences different groups of students and standardized tests. The second section describes how educators have taught mathematics and reading in union. The last section introduces how the writing process should be incorporated into mathematical comprehension as a means of increasing knowledge of

mathematical language.

The use of comprehension in reading is a critical component for students to utilize when fully engaging with mathematics in a classroom that is rich with mathematical language (Adams & Lowery, 2007). The classroom is where students need to connect the application of mathematical concepts with the use of reading strategies. When this is achieved, comprehension has been achieved in a mathematics classroom, giving students an advantage when performing mathematical activities such as solving word problems, computing/calculating, designing and interpreting graphs, responding to open-ended and multiple choice questions, and expressing the relationships between real-world situations and mathematical concepts (Adams & Lowery, 2007). Therefore, classroom mathematics teachers need to be aware that it is their responsibility to teach reading strategies so students are integrating literacy with mathematical understanding.

To teach reading comprehension in mathematics often proves to be the most difficult for teachers. Hoover and Gough (1990) believe that the two mechanisms of word recognition and understanding language are at the center of implementing reading strategies while instructing mathematics. There are three specific reading strategies students can practice to develop a deeper knowledge of the complexity of mathematical reading (Hoover & Gough, 1990); those strategies are decoding, vocabulary development, and comprehension.

When reading mathematical text, it is essential that students are able to organize their full understanding of the text by being able to create meaning from the text. The skill of decoding comes into practice when students are able to use numerical understanding to solve for meaning (McKenzie, 1990). When students have become

strong decoders of mathematical language, they have begun to master the skill of identifying and assigning meaning to the many mathematical symbols used in mathematical instruction (Reehm & Long, 1996). Since there may be some misinterpretation of what the symbols mean in mathematics, it is important for a student to have a developed vocabulary to assist in comprehension of text.

Mathematical reading involves being able to recognize words that are written in the form of mathematical language. The first activity a teacher must incorporate would be to activate prior knowledge in order to find out if the words are in the students' vocabulary. However, students may be unaware of how to use those words in the mathematical context given, which results in a lack of proper interpretation of mathematics. Carter and Dean (2006) suggest that numerous opportunities should be given to students to clarify and extend their knowledge of words and concepts in order to build on conceptual knowledge of mathematical terminology. Strengthening mathematical vocabulary will strongly aid in the goal of building on reading comprehension.

In terms of reading, comprehension can be defined as reading for meaning. In mathematics, reading for meaning becomes extremely layered. Students are asked to anticipate meanings based on prior knowledge, organize new information, connect new learning to old (across numerous grade levels), and use metacognition as a strategy to problem solve. The latter skill is essential in today's high-stakes testing of mathematical knowledge, where students are expected to read and comprehend word problems (Carter & Dean, 2006).

Reading Mathematical Literature

It is important to note that research has proven there is a high-correlation between how well students can comprehend information and their ability to solve problems that incorporate real-world situations by using skills that demonstrate high skill in chart reading, computation skills, and arithmetic.

In an exploratory study conducted by Adams and Lowery (2007), the objective was to determine what specific strategies young elementary students employ to navigate their way through the reading of mathematical literature. The purpose was to examine how students are able to comprehend the context of a textbook and a children's trade book. It was found that students use two different strategies when experiencing mathematical language in different texts; Rosenblatt (1991) mentions that students who read aesthetically are reading for enjoyment and pleasure from the material, while students who read for an efferent stance are reading to gain knowledge through the gathering of information in text. Both strategies are linked to students acquiring understanding of text through the knowledge from their daily-lived experiences (Adams & Lowery, 2007).

Two students were used in the study: one female (who read above grade level) and one male (who read at grade level) in a fourth grade class who were enrolled in a charter school, where the enrollment is 100% African-American (both students were African-American), and the school was designed to empower and enlighten students who possessed struggles in the classroom to become successful learners. The classroom teacher selected the students based off of their results from the state's standardized reading exam and scores from their classroom assessments.

Students in the study were instructed to participate in two separate reading activities. The first activity was designed to have students read aloud from a mathematical trade book and answer research developed questions to test their comprehension and inferential skills of the mathematical context included in the story; researchers were interested in examining the progress of the students experience with reading mathematically. The second activity was designed to have students read aloud from a fourth-grade mathematics textbook, and observe which comprehension strategies they used to solve four word problems that dealt with numerous mathematical applications (measurement, use of formulas, area, perimeter, volume).

Findings from the study suggested that both students lacked background knowledge of specific mathematical terminology in the first reading activity (with the children's trade book), but did have experience with basic knowledge of how to solve the problems, such as when to use multiplication and addition. Caldwell (2002) stresses that the lack of comprehension in reading literature makes it difficult for students to integrate mathematics in reading activities to make for a greater understanding of mathematics. Rosenblatt (1991) supports this by stating that without comprehension, transaction of information in text cannot take place. In the second activity, students did display knowledge of how to answer word problems dealing with dimensions and calculating area and perimeter. However, the process they used to solve the problems was not the formal method introduced in the research; students were comfortable solving problems using methods that they were used to. The results from the observations showed that students drew on their prior experience with solving similar problems, but were used to shortcuts or tricks taught by former teachings, which could negatively impact their

learning mathematics in various contexts.

The students could have benefited from an activation of prior knowledge of specific mathematical language prior to participating in any of the reading activities. While it is important to acknowledge students' strength of using their lived experiences, teachers do not want to lose the opportunity to expose students to language used in various contexts so they are not confused when those terms appear in readings. It is also important for teachers to feel an obligation to "fix" student learned nuances, such as substituting incorrect names in place of correct ones because that is what previous teachers taught them, for it will help strengthen students reading skills across different contexts. To understand how effectively teachers must design instruction in order for students to be able to make connections when interpreting mathematical language, the relationship between mathematics and reading must be analyzed.

Teaching Mathematics and Reading

In a study conducted by Carter and Dean (2006), it was found that some students across the United States have difficulty comprehending content-area literature, specifically mathematical literature. The study explains that the difference between reading for leisure and purposeful content area reading is that reading for content helps students acquire and apply new knowledge through the development of new concepts (Carter & Dean, 2006). The study then mentions that teachers must find it essential to incorporate reading instruction with their math lessons in order to help promote student proficiency in reading mathematically in order to solve problems. The study suggested that teachers should be properly trained to incorporate direct, systematic instruction in reading strategies for comprehension of their mathematical instruction (Carter & Dean,

2006). The study examined instructional methods of different mathematics teachers and if they paired reading strategies with their daily mathematics instruction.

The procedure for the study was to organize a mathematics clinic at a public university in the southern part of the United States. Subjects for the study were students who were entering the grades of 5th through 11th (a total of 14 students participated in the study); the information given about the students in the study was limited. The students received instruction during the month of June 2004 that would aid in the improvement of their mathematical competencies. The instructors that participated in the study had varying educational and experiential backgrounds (a total of eight instructors participated in the study). Students were scheduled to attend the clinic for three hours a day, four days a week, during a three-week period. The program's module is listed below:

- Hour One: Students work individually or in pairs with their primary instructor
- Hour Two: Students work in groups of three or four
- Hour Three: Students work in groups of seven for completion of larger projects

Instructors were aware that the main focus of the study was to observe student mathematical competencies and improve them; instructors however were unaware that they too were being observed for how their lessons incorporated the instruction of reading strategies, such as comprehension, along with their mathematics lessons. Results from the observations were to be analyzed and notes were to be taken as to how teachers interacted with their students during lessons, and how students interacted with other students as well.

In the study of Carter and Dean (2006), it was found that of the eight instructors in the program, three specific reading strategies were their focus during instruction: 1)

instruction on how to decode, 2) introduction of new vocabulary, and 3) instruction of comprehension strategies to better understand word problems. In ranking the frequency in instruction of the reading strategies, teaching comprehension strategies ranked second highest behind vocabulary instruction and above decoding. It was shared that reading comprehension is of vital importance for the goal of producing students who can continue learning without the aid of a teacher (Carter & Dean, 2006). However, some teachers neglected to allow students to focus independently on their comprehension of mathematical material (i.e., reading to students, instead of letting them read aloud, and not using questioning to further understanding and activate prior knowledge).

The study showed that students had better experiences in the summer program when teachers were aware of their role as teachers of reading and mathematics (Carter & Dean, 2006). When teachers monitor student comprehension properly, it is expected that students yield an improved understanding of mathematics.

In order to assess the growth of student comprehension more deeply in mathematics classrooms, schools must analyze students' ability to gather, display, and interpret data. Numerous opportunities must be provided where students can display mastery in their numeracy skills (Blagdanic & Chinnapan, 2013). One of the most authentic methods to implement is to have students demonstrate an ability to interpret real-life data.

Lessons Using Real-Life Data

In a study conducted by Blagdanic and Chinnapan (2013), there was a focus on middle school students' skills of being able to interpret real-life data and generate knowledge through the demanding area of statistical literacy. The study centered around

how students engage with the information more deeply, through information gathering, presenting the data, and investigating through analysis of data and problem solving through interpretation and evaluation of their findings. The researcher hypothesized that students must participate in numerical literacy focused activities to effectively connect learned mathematical concepts to interpreting real-life data in graphs.

The independent variables were the types of graphs students selected to represent the data given in the study (bar graphs, cluster graphs, line graphs, circle graphs). The dependent variables were the results of the visual representations that were presented in class after the data was collected.

The study consisted of Year 7 students at an Australian middle school; Year 7 in Australia is the equivalent phrase to students who are in the 7th grade in the United States of America. The study examined students' knowledge of being able to highlight the pertinent information from a nutritional tag of a breakfast cereal box. Students were expected to graph an appropriate representation of the data presented by selecting the most appropriate informational visual (bar graphs, line graphs, etc.). Upon drawing the graphs, students would then need to answer a series of semi-structured questions about their graphs; the questions would serve as a mean of supportive focus for each student's respective graph. If students were able to arrive at thorough explanations about their graphs, it was examined how well they were able to organize/tabulate/interpret the data that was given in a real-life context.

In the study, Blagdanic and Chinnappan (2013) introduced the process of extrapolating and interpreting data. The phases were: Phase 1: Students' construction of graphs using a given set of decontextualized data: students take data from a table and

construct graphs that represent the data that is representative of their knowledge of a graph's components (titles, axes, scales, etc.), Phase 2: Students' extraction and tabulation/organization of data from a real-life context (contextualized data): students picking pertinent information from context and applying it to a table before constructing a graph; this will help them when make sense of the data before AND after the graph has been constructed, Phase 3: Students construct different types of graphs using organized data from Phase 2: students explore the different types of graphs and decide which one is most appropriate for conveying the information they have, and Phase 4: Students learn to interpret information from the graph: students use the graphs to interpret information and are guided by teachers on how to analyze data deeply through questioning and other evaluating strategies.

Blagdanic and Chinnappan (2013) found that all Year 7 students were capable of constructing graphs. However, there were students that struggled in Phase 3 of the process (the construction of their graphs). The misunderstandings ranged from students a) not understanding the nature of the graph (knowing which type of graph to use) and the data that needs to be analyzed (interpreting the data and applying it directly), b) not being able to cluster/group the data appropriately before graphing, and c) being confused about identifying parts of the graph and drawing connections from there.

It was found that students who experience difficulty in the classroom have the struggles in extrapolating the data and being able to group it in its most appropriate areas so the findings are organized clearly and thought provoked. If this is a challenge from the start, the second challenge becomes that students cannot create effective visual representations of the data if they are not able to interpret the data in its full context.

The connection to draw here is that students are in need of practicing some pre-graphing strategies that will aid the students' practice of producing graphs of the data. One strategy could be 1) group discussion about the data presented and the types of graphs to use which will help activate prior knowledge or help students think clearly about the different graphs of data, 2) raise questions as to which information is important to the outcome of the research, 3) have students organize the data before entering it into any visual representations, 4) have students construct more than one type of graph, and 5) students take their graphs and compare/contrast the results of their visual representations in order to draw clear conclusions from the data.

When students are able to draw final conclusions from the collection of data, it shows that they are ready to proceed in speaking, listening, reading, and writing to communicate a full understanding mathematical words, symbols, and concepts from multiple representations (Chappell & Thompson, 2007).

Communication of Mathematical Language

A study conducted by Chappell and Thompson, (2007) was conducted to encourage mathematics teachers across the United States to take on the responsibility of teaching their middle school students to use multiple modes of communication in order to effectively engage in the learning process of mixing literacy with mathematics. The study touches on the idea that teaching literacy in mathematics is crucial to students' development of being able to effectively use mathematical language; if the expectation is for students to be able to communicate mathematically in the world outside of the classroom, how integral then is it that teachers include teaching literacy in the mathematics classroom, where there is only limited time for students to build on their

literacy (2007)?

Students included in the study were of middle school age (11-13 years of age) and high school age (14-18 years of age); information given about the student participants was limited. In the study, the students were evaluated in terms of how they 1) organize their mathematical thinking through communication, 2) communicate their mathematical thinking coherently to peers and teachers, 3) analyze the mathematical thinking of others, and 4) use mathematical language to express mathematical ideas precisely (Chappell & Thompson, 2007). The study administered a series of items to students where they were taught the following modes of communication: Speaking and Listening to Mathematics, Writing Mathematics, Reading Mathematics successful learners.

For students who were taught to *speak* and *listen* to mathematical language, teachers conducted numerous activities to aid students in becoming more fluent communicators in the classroom. Activities such as creating personal vocabulary dictionaries for content terminology, back-to-back figure descriptions when discussing polygons (helps students focus on talking and listening to each other), and creating a deck of cards with steps written on them to help teach the multi-step equation solving process.

For students who were taught to *write* mathematical language, teachers introduced two different types of writing styles where students exhibited their understanding of mathematical concepts. The two styles were transactional, which students can use to communicate effectively to each other and to their teachers, and expressive, which can be described as exploratory writing when students are in the beginning stages of note taking in a mathematics class. Both styles are then modified to assist students who are having difficulties explaining their thinking, and comparing and contrasting concepts (2007).

For students who were taught to *read* mathematical language, teachers were aware that the difficulty with this component was that students have a tougher time with vocabulary development in a mathematics class than in an English class. The interesting thing Thompson and Rubenstein (2000) mentioned is that the academic contents of English and mathematics share words that have distinct meanings in varying contexts. Because of this, teachers have to use several strategies that will help develop student vocabulary, which will assist in comprehension of mathematical ideas.

The study suggested that students require a level of instruction in the area of communicating mathematical language in order to be considered fluent in their knowledge of mathematical literacy. In order for students across the United States to become competitive in how they communicate mathematical language, they must possess a skill to speak, listen, write, and read mathematically with their peers. But for that to take place, teachers must take ownership of the classroom instruction to focus their efforts on helping students become skilled communicators of the content. The representations Chappell and Thompson suggested teachers focus on introducing to students were symbolic representations, verbal representations, tabular representations, and graphical representations. It is also essential for teachers to include those students in the learning process that have learning difficulties with mathematic literacy.

Math Literacy for Students With Learning Difficulties.

In an article written by Kiuahara and Witzel (2014) the importance of inclusive education for students with varying learning abilities, challenges were addressed. It discussed how schools across the United States are trying to implement literacy and reasoning skills in the classroom in order for children to exhibit mathematical

competency. Kiuahara and Witzel argued that the challenge is not only with students who are categorized with disabilities, but for those students who are without disabilities as well. The goal of trying to implement rigorous instructional standards across states is for students to learn not only the content and the procedures for calculating an answer, but they also must explain their mathematical reasoning during problem-solving (Kiuahara & Witzel, 2014). The authors suggest that the pairing of reading and writing strategies can strengthen students achievement in making sense of mathematical problems in and out of the classroom.

The hypothesis here is that students will effectively connect learned mathematical concepts to solving word problems when teachers take a meta-analytic instructional approach, such as schema instruction and self-regulated strategy development (SRSD), in the classroom environment. The included variables were students NOT receiving explicit instruction with the SRSD strategy (control group) and students engaged in the complex cognitive processes of using the SRSD strategy through explicit instruction (experimental group). Participants in the study included students in the United States with AND without emotional and learning disabilities; fourth grade level students through eighth grade level students; 15 year-old students; students struggling to master mathematical literacy and reasoning skills. This was the identifying information given for student participants.

Methods for the study included classroom instructional approaches for promoting mathematical reasoning with schema instruction and SRSD strategy:

Schema Instruction:

- F = Find the problem type
- O = Organize the information using a diagram
- P = Plan to solve

- S = Solve

SRSD:

- Develop background knowledge
- Teacher and students talk through strategies
- Model using think-alouds
- Memorize it
- Guided practice using the strategies (with support)
- Independent practice

From the research, Kiuahara and Witzel found that when students were taught how to approach solving problems, the math reasoning teachers used for students were schema-based and schema-broadening instruction. Teachers found it useful to teach students to evaluate what underlying structures were apparent in a given word problem. By translating information in the word problem, students were able to solve problems by grouping them by type (i.e., compare problem, change problem, problem with new vocabulary).

Kiuahara & Witzel suggested that the instructional approaches were essential when considering their use as tools for helping students elaborate on and translate information of given word problems (2014). In order for the tools to work effectively for students, they must be able to pair reading strategies, such as metacognition, and writing strategies, such a journal writing, to make clearer sense of mathematical problems.

Strategies of Comprehension to Use in Mathematics

A number of recommendations were made for consideration: 1) it is essential that teachers learn how their respective students learn mathematical concepts before implementation of such strategies, for it is important to consider the different learning modalities of each and every student, and 2) from there, identify best practices for students to engage in information sharing in the classroom. One method students can

practice in gathering information is being able to write structured meaning of mathematics that will allow them to individually learn at their own pace (Borasi & Rose, 1989).

Journal Writing.

In a study conducted by Borasi and Rose (1989), students in a mathematics course were instructed in journal writing for class in order to keep up a running dialogue with their instructor. The purpose of the journal writing was meant to create a meaning-making process that involves the learner in actively building connections between what they are learning and what is already known (Borasi & Rose, 1989). The study classified this notion as *writing to learn* (1989).

The study further analyzed the concept of *writing to learn* under the suggestion that the technique could mostly benefit the student-teacher relationship in the classroom, by allowing open dialogue between the two parties. Not only could a student's learning improve through the process of *writing* in a journal when certain mathematical concepts are challenging to comprehend, a teacher's system of instruction (planning and preparation, classroom environment, instruction – teaching style) could also experience gains (1989) from *reading* their students' journal entries.

The study included 29 student participants that were enrolled in a 3-semester hour course at a small four-year liberal arts college. Students were in their first and second year of business school with varied backgrounds and abilities in mathematics. From the 29, three withdrew and one failed to even participate in the journal keeping process; 23 students wrote regularly in their journals and had feedback for the teacher at the conclusion of the course. This was the identifying information for the student

participants.

Independent variables were the decisions of students to keep journals in class and actually participate in the journal entry process. Dependent variables could include the different motivations of students that were enrolled in the class – did they see the journal entry writing as beneficial to their learning the daily mathematical concepts. The setting for the study took place in a college mathematics course at a small liberal arts college in the U.S.A. The students taking the course were predominantly majoring in business in their freshman or sophomore year of college.

Students were expected to write three entries per week, which the teacher collected every other Friday, giving the students more than ample time to produce some entries from past lessons instructed. The rationale behind the journal entries was to give students an opportunity to reflect on express feelings about the mathematical content of the course, provide input to the teacher, and engage in weekly dialogue. After reading the entries, the teacher would return the entries to the students the following Monday; the entries would include comments from the teacher as to open up a back and forth dialogue with the student about their questions, reflections, and such.

Results from the journal entry experiment were analyzed and evaluated at the end of the semester. After compiling the data, it was determined that there were some major wins to consider with the journal entry student writing and teacher reading: 1) students increased knowledge of mathematical content through writing about the material lead to an acquired skill in how they inquire about questions, 2) students improved problem-solving skills from articulation and reflection made for an increase in engaged involvement in the learning process, 3) steps were taken by students to gain a more

comfortable view about the nature of mathematics and its place in the real-world, 4) teachers increased individual knowledge of all of their students and their learning styles, 5) teachers were able to make effective and immediate changes to instruction through reflection from reading student feedback, 6) gained teacher knowledge to improve upon personal education pedagogy in the classroom, and 7) a more trusting, non-adversarial classroom was created through student-teacher relationships that were committed to improving throughout the duration of the course (1989).

The connection to draw here is that students experience high needs challenges in mathematics that stem from a number of negative notions: anxiety, disinterested learning (for example, the completion of simple worksheets), and passive learning (for example, students just wanting the answer and not wanting to know how to solve a problem) to name a few. Borasi and Rose (1989) researched the usefulness of using journal-writing with classroom instruction to encourage students to break their misconceptions about mathematics in hopes that they become more proactive about their learning in the classroom.

Writing to Read

This report presented information to expound upon the need for strong literacy skills in students by identifying writing practices found that are effective in increasing reading skills and comprehension. The hope is that by providing classroom teachers with research-supported information about how writing can improve reading, action will be taken at the policy making and research levels, leading to the greater use of writing as a tool for enhancing reading and a greater emphasis on the teaching of writing in our

nation's schools. Research intended to prove that direct instruction in writing strategies would improve students' fluency in reading comprehension.

Participants that were the subject of the research were students grouped in grades 1 through 12; the gender and ethnicity of the students were not given. The experimental group of students included in the research was in grades 1-12 and received intervention in writing strategies to improve their reading skills and comprehension mathematics class. The control group of students included in the research was in grades 1-12 and did not receive the special intervention to apply in their mathematics class.

Meta-analysis was the method used to measure the effectiveness of using supported writing practices for improving students' reading. The practice focused on gathering various studies that combined the numerous outcomes of the findings in hopes of compiling a cumulative report in which recommendations were suggested. Through the collection and categorization of data presented on the effectiveness of the use of writing practices in classrooms, a few techniques were analyzed in particular: 1) writing about text, and 2) the teaching of writing.

Having Students Write About the Text They Read

- Students respond to a text -
 - The study analyzed the effects that extended writing had on students' overall reading comprehension gains. In nine studies that focused on this component of the research, positive results were yielded from each study. The studies examined the positive impact that guided journal writing produced in greater comprehension, rather than simply reading text,

rereading text, studying text, and receiving reading instruction (Graham & Hebert, 2010).

- Students write summaries of a text –
 - The research conducted analyzed the positive effects that writing a simple sentence in response to a reading can have on a student's reading comprehension. For the students in grades 3-12, 19 studies were conducted and 17 yielded positive outcomes (89 percent). Students were instructed on how to identify main information, delete unimportant information, and support their findings in a short explanation of what was read. Different summary writing strategies were taught with different content specific reading materials.
- Students take notes on a text –
 - The research conducted in this study yielded positive results in 21 of the 23 studies (91 percent). However, it was noted that there is no one way that a student can effectively take notes in order to build on reading comprehension. Teachers who introduce this strategy must make sure to model an effective format that students can utilize to organize their thoughts and the read material clearly. Note taking involves connecting the abstracted material in readings with personal knowledge (Graham & Hebert, 2010).
- Students answer questions about a text in writing or create and answer written questions –

- This skill aided students' memory building of key information that was read, as written responses to written questions served as review and prior knowledge (Graham & Hebert, 2010). The research conducted for this section of the study generated all positive reviews (8 out of 8) where students were consistent at generating questions about their readings and showing inferential skills about what they previously read.

Teach Students the Writing Skills and Processes That Go Into Creating Text

- Teach process of writing to improve reading comprehension –
 - It was examined that teaching students patterns for constructing sentences would increase their comprehension while reading for information. Only 79 percent of the results yielded in the study considered this strategy effective for student comprehension. Reasons being that there were a variability of types of writing instruction that teachers could present to their students (Graham & Hebert, 2010).

Conclusions to the research were as follows: 1) teaching “*writing to read*” activities does not replace the effectiveness of knowing how to read, but serves as a complement in the knowledge gaining process, and 2) schools should incorporate explicit instruction in writing practices (note taking, sentence building, journal writing) as a means of building students' reading comprehension abilities.

Integrating Writing and Mathematics

This article reflected on the practice that teaching writing skills in a mathematics class is essential to a student's ability to gain access into becoming a more informed writer in the respective content. The article listed two specific practices that teachers

need to incorporate in order to fully integrate the two respective disciplines: student writing without revision and students writing with revision. Both practices happen at different times of the student learning process, but both are necessary for students to attain some success in the writing process in mathematics. Together, the two levels of writing instruction (independent and dependent) will increase student writing in the mathematics classroom.

Students grouped in grades 3 through grade 5 were researched with using the methods; student gender or ethnicity was not given. Teachers were in charge of monitoring students during instruction. The experimental group that was researched was the group of students in grades 3 through grade 5 that wrote in their mathematics class with self-revision to their writing, and revision from the teacher. The control group that was researched was the same grade level of students, but who wrote in their mathematics class without self-revision or revision from the teacher.

Expanding on the note-taking method used in mathematics classes, the article addressed the practices of teachers trying to help their students connect prior knowledge to newly instructed information. The article focused on the effectiveness of the practice that was introduced to fourth and fifth grade students. Students were encouraged not only to take notes, but also to *make* notes (Monroe & Wilcox, 2011).

Through this process, students were expected to record instructional material in their notebooks in order to refer back to main points later in the section, while also writing down personal reflections of how they came to conclusions. This strategy helped guide student thinking in the direction of becoming stronger thinkers and understanding the concept of how to connect their mathematical learning to the skill of writing.

The results of the research were reported as such:

Writing Without Revisions

- Note-Taking/Note-Making
 - Students in fifth grade took notes during a teacher's instruction on the left side of their notebooks (definitions, notes from the board, and problems from worksheets).
 - Students wrote down how the current lesson connected with previous taught lessons on the right side of their notebooks.
 - Students were able to reflect on how they felt about the lesson, serving as a journal today's lesson.
 - The journal served as an open dialogue with the content itself, as if they were trying to *get to know* the math that was taught.

Writing With Revisions

- Shared Writing
 - A third grade teacher reviewed with students some of the concepts that they learned in geometry by creating word banks and writing umbrella concepts on the board.
 - Each word was written in one color, while the concepts were all represented with different colors.
 - Students were then guided to share in the teacher's process by recording the learned information in their notebooks.
 - Students were then guided to make revisions to their writings, by making additions to what they already recorded, and by having open conversations

with one another to come to concrete conclusions about which keywords belonged under the key umbrella concepts.

The *writing without revisions* practice is an essential component of the union of writing and mathematics for it honors both disciplines while taking into account that they are not independent of each other. Students are more successful mathematics writers if they are allowed to write at their own pace to start, then the revision process becomes necessary to expand that writing growth.

The *writing with revisions* practice engaged students in a process where the strategy helped students internalize mathematics (Monroe & Wilcox, 2011). Students were able to draw deeper connections with the material rather than just copying notes from the board as the teacher instructed. Shared reading/writing allowed students to share in the instructive process and hold them accountable for not only interacting with the material, but also interacting with one another so they are more capable of communicating mathematically independently. Teachers should be more cognizant about including writing activities in mathematics instruction so writing scores across contents can increase (Monroe & Wilcox, 2011).

It is noted that the significant union between teaching students how to better comprehend information through the skills of text coding and journal writing helps create more effective readers of mathematics. Young people stand to benefit from this, as research shows that teaching these skills as early as elementary school will result in students becoming stronger readers.

Reading Comprehension in Mathematics

This article examined the important role that reading comprehension plays in a student's success in mathematics. In further detail it's mentioned what are the causes of comprehension failure when reading in a mathematics classroom. To avoid comprehension failure, a student's active reading ability must improve in order for them to improve their mathematics skills.

The article did not include variables or a full extensive list of participants. The article was intended to showcase students who are learning to read at different paces nowadays, which presents some difficulties in the discipline of mathematics. Students are already faced with the challenge of solving equations with symbols and coming up with calculations for problems, but when presented with words that are interwoven in mathematical language, students struggle. The challenge that occurs comes from the fact that reading mathematical text is "different from learning to read word problems, which is invariably compact" (Fuentes, 1998). Because of the complexities of reading mathematics, active engagement in the reading process is necessary for desired understanding.

First, students need to be taught the idea of text directionality that is taught when reading expository texts. However, mathematics texts may require a unique twist on the strategy, for math language differs than that of other disciplines. Fuentes (1998) mentioned that there is a natural relationship in English between subject and verb when building the structure of sentences. In mathematics, that structure does not work in the same particular fashion. Elements of mathematics are fixed and not so interchangeable (such as how to perform the Order of Operations). Secondly, students need to be taught

how to interact with the unique vocabulary of mathematics (1998), for some words are used in the ordinary English language, yet carry very different meanings (e.g., factor, product, rational, origin, mean, real).

Because of the complexity in language, teachers should opt for approaches in teaching reading instruction that helps students fully engage with the material. Fuentes suggested that teachers should teach students how to use diagrams and word maps that could aide students with their understanding of unknown text. These coding activities factor into how well a student processes mathematics rather than a lecture (1998).

For students who have trouble with comprehending problems and solutions, teachers often have to review the issues that students have when reading mathematically. Research suggested that students lack sufficient understanding of how to interpret mathematical language, thus instructing students how to “get the author’s intended meaning” (1998) is important for students to learn when organizing knowledge.

Fuentes wrote that attributes that are contributive to good readers of mathematics are those that “lighten mathematics anxiety” (1998). The characteristics of good readers in mathematics include keeping a running journal that helps students better communicate with the learned material, and being able to construct their own meanings from the readings through hands-on activities that help them interpret graphs and tables in their own words.

Reading strategies and writing strategies should be taught not as separate entities, but as joint skills. In doing so, teachers would be better able to assess the effectiveness of their students’ understanding of mathematical content; the more the practices are paired,

the better chance a student will become an effective learner in the mathematics classroom.

Learning and Assessing Mathematics Through Reading and Writing

This article explored the dual role that reading and writing has in helping students learn mathematics more effectively. Students can benefit from a deeper understanding of the mathematics discipline while integrating techniques in the classroom that will aid them in practicing their skills of mastering comprehension of mathematical text. The thought presented is that active reading and writing *about* mathematics is more effective as a technique for deeper understanding and comprehension of mathematics text than reading and writing *in* mathematics.

Participants mentioned in this article were preservice and inservice K-12 mathematics teachers; their students were not fully described. Researchers presented their findings through experiences and observations to the teachers via workshops. The purpose of the workshops was to provide mathematics educators with information regarding how a student simultaneously learning mathematics through reading and writing in the classroom could provide for deeper understanding of the content. Furthermore, the article explored the vital role that reading and writing share in the mathematics classroom. Teachers presented a number of techniques that promote successful integration of reading and writing in mathematics.

1. Highlighting text structures and vocabulary:

Bosse and Faulconer (2008) researched that a student's knowledgeable skills in comprehending narrative text have a strong correlation to how well they can comprehend mathematical text. Though narrative text differs from expository text, they share the same

style of interpretation that becomes helpful when evaluating and extending text mathematics text. Because of this correlation, it is essential that mathematics teachers demonstrate how the use of vocabulary and text coding techniques all work in tandem (2008) to create a skill set that is appropriate for students to deeply understand mathematics text. Mathematical Recommendations

2. Reorganizing the Text and Exercises

The natural layout of mathematics textbooks has been to present page after page of discussion notes, followed by modeling examples of how to solve problems, as a means to give students an idea of how they are to independently solve problems (Bosse & Faulconer, 2008). Problems are presented when students rely too heavily on the models as their choice method of completing exercises. This could be attributed to the thought that this presents an inhibitor for students reading the text (2008). Students typically skip all the explanatory text and focus attention directly on exercises, only returning to the text when sufficiently stymied by a problem (2008). Students who attempt to read the math text and jump straight to solving exercises tend to have the most difficulty solving problems independently without teacher guidance. To see students have more success with connecting to the text, it is appropriate for them to make connections with the text first. This is necessary in order for students to see the text as a valuable instructive and not simply a backup when homework becomes too difficult (2008).

3. Blue Box Techniques

Mathematics textbooks have historically presented information in common ways, such as the introduction of new vocabulary terms and formulas. Research has shown that the presentation of this information is usually given in blue colored text boxes (Bosse &

Faulconer, 2008). A technique that students could benefit from is that upon completion of reading the text boxes have them clear their desks and model a scenario of their own using the vocabulary, formulas, and text from the blue boxes. This demonstration will give students practice with not only reading and writing mathematically, but also communicating through reflection.

4. Changing Definitions

Some mathematics educators have suggested as classroom experiences that teachers purposefully and carefully alter words in definitions and theorems (Bosse & Faulconer, 2008). The teacher changes a number of words in the text (never changing the meaning implied in the text) and then students openly discuss the meaning of the statement. The open discussion leads to more careful reading for students (for the teacher may have switched out vocabulary with terms more familiar to the students). The hope is that students will gain an appreciation for the precision by which mathematics is written. Numerous mathematics educators and researchers advocate that it is a student's understanding of mathematical vocabulary that is significantly connected to their understanding of mathematics (Bosse & Faulconer, 2008).

This experience of teachers switching out definitions and having students discuss the meaning of the terms in relation to the problem leads students toward the mastery of the content's concepts and vocabulary (2008).

5. Unpacking Mathematical Texts

With mathematics text being written in a very succinct way (much different than an everyday narrative), the language is usually presented in a compressed format that gives students a better chance to understand what is being communicated. Because of its

presentation, mathematics textbooks require comprehension skills that involve interpreting vocabulary, tables and graphs, symbols, and diagrams (Bosse & Faulconer, 2008). Knowledge of coding text is appropriate for student readers who often feel navigating mathematics text is difficult. Reading mathematics challenges students to acquire mathematical comprehension through reading simultaneously numerals, symbols, and words (2008). To become successful readers of mathematics, students must understand what is being communicated, which is why unpacking text is necessary.

In teaching reading and writing *about* math, teachers provide students with opportunities to share their deeper understanding of the content, rather than simply reading and writing to earn a grade. Mathematics learning becomes more purposeful when students are able to grasp concepts apply them to different situations (Bosse & Faulconer, 2008). The multiple techniques mentioned in the article promote the integration of reading and writing in mathematics, giving teachers successful methods to introduce to their students in hopes that they develop an inherent knowledge of how to communicate mathematically.

Research shows that the teachers are most successful when providing students with the most appropriate techniques that aim to increase reading comprehension in mathematics. Such techniques are meant to alleviate some of the anxiety that students have with reading writing in mathematics classes.

Teachers work extensively with academic support teachers to incorporate such instruction in their lesson planning as it helps build stronger relationships with students. The hope is to create a more conducive learning environment for all students that possess different learning modalities.

Analysis of Comprehension Strategies in Mathematic Classrooms

In a study conducted by Bach, Bardsley, Brown, and Phillips (2009), teachers in a mathematics classroom worked closely with their middle school literacy coaches to explore possible integrated classroom systems that could assist in helping strengthen reading instruction in the mathematics classroom to students who were in need of attaining a proficient understanding content fluency and vocabulary. The purpose of focusing on this area of literacy is important when you consider that mathematics is a language of its own, where students need to be aware of how to speak, read, and write two languages simultaneously (Fuentes, 1998).

In order to get students and teachers alike to focus in on mathematics and literacy as a joint relationship in the classroom, a study needed to be conducted. The project included a joint effort between Niagara University and a high needs urban school district in New York State. The studied further analyzed the role of teachers in the high stakes of where their students reading ability lies in the mathematics classroom. The professional development that middle school teachers received in order to develop their personal understanding of how to link literacy in the mathematics classroom was funded by the United States Department of Education. The project consisted of two phases: Phase One was designed to encourage teachers to think of methods to create structure around how questions are presented in class, how vocabulary is learned by students, and what students need to become higher level math literate students.

Phase Two was designed to consider the application of teaching reading in mathematics. For example, teachers would consider the text styles of their content textbooks and create lessons on how to use certain practices when reading in class: use of

graphic organizers, read aloud think aloud, K-W-L charts, and other methods that could serve as useful for improving literacy in the mathematics classroom.

Towards the conclusion of the project, teachers realized that their sole purpose in the classroom was to teach their students how to make connections of the learned mathematical and literacy skills across numerous contents, and having those skills also transfer over to being used in the real world. Bach, Bardsley, Brown, and Phillips (2009) wrote that a student's growth in the classroom is obtained through the confidence and knowledge their teachers and administrators possess in the effort to rally around the idea of student need in acquiring high-literacy in mathematical content. If a more effective "top-down" model is developed, learning environments will become more powerful.

Creating a Framework System for Mathematical Learning Environments

In a study conducted by Corte, Masui, and Verschaffel (2004), research was conducted to examine the learning environments of classrooms in Belgium. The purpose of the study was to focus in on the framework needed to develop a more powerful, high-literacy based classroom for students who struggle with mathematical problem solving in the classroom. By using the CLIA (Competence, Learning, Intervention, Assessment)-Model, the study aims to present results where use of the model could be a powerful tool used in the design and development of effective learning environments.

The study touched on the significance of how the use of mathematical reasoning and problem-solving skills were essential to the development of how confident young students felt about mathematics class. The study was conducted in Belgium with participants consisting of primary school aged children. There were four classrooms selected as experimental groups, whereas the remainder of the classrooms was control

groups (seven classrooms); the identifying information for student participants was limited. The study was conducted under the commission of the Department of Education of the Flemish government.

Students in the experimental group participated in special interventions that were set up to foster positive mathematics-related beliefs (Corte, Masui, & Verschaffel, 2004). The CLIA-Model was instituted where students were presented with different forms of word problems (textbooks, newspaper articles, brochures, comic strips, etc.), teachers introduced metacognitive strategies to be used by students in order for them to become more responsible for their learning community, which would lead to more meaningful student engagement in helping build an innovative classroom culture.

Upon completion of the interventions, the study's results reported that student achievement from the experimental group was substantially better from the achievement of the students in the control group. The intervention study was intended to advance thinking about the better understanding of what learning environments should look like for students (Corte, Masui, and Verschaffel, 2004). By using additional strategies and not just sticking to the content resources of the classroom, teachers can work with their students to create innovative environments where learning is powerful and meaningful. Support for CLIA-based learning environments is admitting that by combining a carefully designed space where students can apply metacognitive strategies to solve problems, students will boost self-regulatory skills of their own learning, which will lead to a boost in student competency in solving mathematical word problems.

Conclusion

This chapter summarized information around the discussion of the essential need of reading and writing strategies needing to be taught as supplementary guides for effective mathematical instruction. Implementing reading and writing strategies in mathematics classrooms will further improve student understanding of mathematical language. A focus was placed on defining the different reading strategies used in classrooms, how educators teach mathematics and reading in union, and how the writing process should be incorporated into learning environments as a means of increasing mathematical understanding.

One of the focuses of the research is to analyze the effectiveness of reading strategies such as text coding in a mathematics classroom. This strategy will help students become more comfortable with the mathematical language that is used in content heavy text that they may not be familiar with. Therefore, it is essential that teachers introduce the practice during instruction as a helpful tool for students to use.

Another focus that was addressed was how student comprehension of mathematical content needed to be deeply analyzed by teachers who have been trained to present this type of instruction to students. The research mentioned that students should be given numerous opportunities to display mastery of numeracy skills (Blagdanic & Chinnapan, 2013) by interpreting real-life data.

The last focus of this chapter discussed the usefulness of journal writing as form of learning mathematics in the classroom. The concept is effective as it teaches students how to make connections of the learned mathematical and literacy skills across numerous contents, and having those skills also transfer over to being used in the real world (Bach,

Brown & Phillips, 2009). Students who can gain confidence in speaking and writing mathematics will possess the power to become mathematically literate and break their misconceptions about reading mathematics (Chappell & Thompson, 2007).

Chapter 3

Procedures

This chapter contains information on 1) participants' relevant academic background, 2) the setting of where the study took place, 3) daily procedures used in data collection, and 4) a description of assessments used during the project.

Participants

Student A

He was 14.9 years of age at the time of the study; he is an African-American male. He began his first year of high school in the fall of 2014. Under IDEA, he was a student who met qualifications for special education under the primary category of other health impairment (OHI). His present level of performance in math was well below grade level in comparison with his peers. He struggled with the concept of mathematics when numbers were given in the form of equations; he tends to become confused when asked to solve questions involving multiple variables and multiple steps.

In a conversation with his reading intervention instructor, it was shared that Student A possessed good reading skills in his English and geography classes. The Individualized Education Plan (IEP) included a mathematics goal that was reflective of the Algebra course he was enrolled in. The goal was for Student A to improve on “analyzing and solving real-life and mathematical problems using numerical, algebraic, linear, and exponential equations”. It was written in his IEP that he must receive specialized instruction in mathematics and reading/writing.

Student B

She was 15.1 years of age at the time of the study; she is an African-American

female. She began her first year of high school in the fall of 2014. Under IDEA, she was a student who met qualifications for special education under the primary category of specific learning disability (SLD). Her present level of performance in math was at grade level for an average high school freshman (performing at a Basic-Proficient level). She worked hard to maintain a passing grade in Algebra, and was always seen participating in class to answer questions the teacher asked of the students.

Through observations of Student B's reading, it was confirmed that she reads below grade of the average high school freshman. She struggled with analyzing text in order to form deeper understandings of what she read. In conversations with her teachers, it was shared that she does show effort in independent reading, but needs to connect the text more personally to become a successful reader. Her IEP included a mathematics goal that was reflective of the Algebra course she was enrolled in: *analyze linear equations and understand algebraic expressions*. Her literacy goal was to improve on "comprehending and analyzing literature more independently". It was written in her IEP that she must receive specialized instruction in mathematics and reading/writing.

Student C

He was 15.11 years of age at the time of the study; he is an African-American male. He began his first year of high school in the fall of 2014. Under IDEA, he is a student who met qualifications for special education under the primary category of autism (AUT). His present level of performance in math is at grade level in comparison with his peers. However, he struggled to stay on task during guided teacher whole group instruction. His mathematics instructor noted that he would often go on tangents of problem solving techniques, resulting in the correct answer to questions, but using his

“own” method.

In a conversation with his reading intervention, it was shared that Student C possessed good reading skills in his English and geography classes. He also exhibited strong analytical skills when interpreting information from reading text. His Individualized Education Plan (IEP) included a mathematics goal that was reflective of the Algebra course he was enrolled in. His IEP also included a literacy goal that stated he receives specialized instruction in reading and writing.

Student D

She was 15.11 years of age at the time of the study; she is an African-American female. She began her first year of high school in the fall of 2014. Under IDEA, she was a student who met qualifications for special education under the primary category of specific learning disability (SLD). Her present level of performance in math is below grade level in comparison with her peers. Her IEP noted that she is capable of using problem-solving strategies to solve single-step and multi-step word problems. However, she struggled with completing assignments in a timely fashion, and with completing assignments independently without teacher guidance. Universal screener scores gave an overall picture that Student D was in need of intervention in the areas of algebraic reasoning.

Her past IEP documented her troubles with reading below grade level in comparison with her peers. In a conversation with her reading intervention instructor, it was shared that she possessed good reading skills, but refused to participate openly during class; she was much better during one-on-one interventions. Her (IEP) included a mathematics goal that was reflective of the Algebra course she was enrolled in. The goal

was for her to improve on “analyzing and solving real-life and mathematical problems using numerical, algebraic, linear, and exponential equations”.

Student E

He was 14.7 years of age at the time of the study; he is an African-American male. He began his first year of high school in the fall of 2014. Under IDEA, he was a student who met qualifications for special education under the primary category of specific learning disability (SLD). He also received a related special education service of speech and language (SPL) once a week for 20 minutes. He was pulled from his 7th hour class and worked directly with a school speech pathologist. His present level of performance in math is well below grade level in comparison with his peers. Quentin struggled with the concept of mathematics in a variety of ways; he possessed weaknesses in using analytical skills in algebraic reasoning when variables are given, solving and writing word problems when asked to interpret given information, and solving real number computations.

In a conversation with his reading intervention instructor, it was shared that he struggled to identify between nouns and verbs when reading literature. He did display strength at spelling instructional words, but independently he struggled which impeded his learning at the general education level. His reading fluency was not strong, which then affected his comprehension skills. Because Student E struggled with fluent reading, he had trouble fully analyzing text. His IEP included a mathematics goal that was reflective of the Algebra course he was enrolled in. The goal was for him to improve on “analyzing and solving real-life and mathematical problems using numerical, algebraic, linear, and exponential equations”. His IEP also included a literacy goal that says he will

improve “identifying main/major themes, and use context clues to determine the meaning of vocabulary, and make inferences about reading”.

Student F

He was 14.11 years of age at the time of the study; he is an African-American male. He began his first year of high school in the fall of 2014. Under IDEA, he was a student who met qualifications for special education under the primary category of other health impairment (OHI). His present level of performance in math is at grade level in comparison with his peers. He displayed strengths in identifying how to interpret information when given word problems, and excelled at understanding concepts when they were re-taught. He was very attentive during instruction and participated daily, and if he did not understand something right away, he asked questions. He will continue to improve as the school year goes on.

In a conversation with his reading intervention instructor, it was shared that Student F possessed good reading skills in his English and geography classes. He possessed strengths in organizing his ideas and identifying main ideas of what he read. It was stated that he has been proficient in interpreting information from different types of text. His IEP included a mathematics goal and a literacy goal that was reflective of the Algebra course and English course he was enrolled in for freshman year.

Student G

She was 15.7 years of age at the time of the study; she is an African-American female. She began her first year of high school in the fall of 2014. Under IDEA, she was a student who met qualifications for special education under the primary category of specific learning disability (SLD). Her present level of performance in math is well

below grade level in comparison with her peers. She struggled with mixing up concepts of mathematics from time to time (switching decimals in the wrong place, misreading numbers, typing in information in the calculator incorrectly). An observable strength of hers was organizing steps when solving multi-step equations. Student G did an excellent job of completing mathematical problems by taking good notes and using those procedures to answer questions.

Student G performed well below grade level in literacy as well. In conversations with her reading intervention instructor, it was shared that she possessed the ambition to read independently, but struggled with the skills to do it. Her analyzing information skills were in need of improvement. She will need to continue working on making connections to the material she reads in order to develop deeper understandings. Her IEP included a literacy goal. Her goal was to improve on “analyzing ideas and developing deeper connections with the readings”.

Student H

He was 14.10 years of age at the time of the study; he is a Caucasian male. He began his first year of high school in the fall of 2014. Under IDEA, he was a student who met qualifications for special education under the primary category of other health impairment (OHI). His present level of performance in math is at grade level in comparison with his peers. He struggled with completing assignments in a timely fashion, but could at least complete them independently. His IEP documented that he seeks outside special service to help cope with his anxiety. It is said that his classroom struggles are linked to his indecision when faced to make independent decisions.

In conversations with his reading intervention instructor, it was shared that Student H possessed strengths in reading independently. His attention to focus on analyzing text was at grade level with his peers. However, the tasks were usually completed in an untimely fashion, similar to his actions in mathematics. His IEP included a literacy goal that was reflective of strengthening his completion of independent work when given ample time to complete assignments.

Student I

He was 15.3 years of age at the time of the study; he is an African-American male. He began his first year of high school in the fall of 2014. Under IDEA, he was a student who met qualifications for special education under the primary category of emotional behavior disability (EBD). He also received a related special education service of speech and language (SPL) once a week for 20 minutes. He was pulled from his 7th hour class and worked directly with a school speech pathologist. His present level of performance in math is well below grade level in comparison with his peers. Student I did not participate fully in the general education curriculum during 8th grade in 2013-2014. It was documented in his IEP that his past behaviors were seen as disruptive and resulted in his learning being delayed in comparison to his peers.

His mathematical skills were significantly behind the 9th grade level, as he was asked daily to complete abstract mathematics using numbers and variables. He struggled to complete one-step equations and possesses a weak number sense. In describing his literacy skills, Student I displayed some strength in oral reading fluency. He was in need of significant improvement in the area of independent reading and analyzing text. His IEP included a mathematics goal that was reflective of the Algebra course he was

enrolled in. His IEP also included a literacy goal reflective of the English course he was enrolled in.

Setting

The case study was performed at an urban public school in the city of Milwaukee, Wisconsin. Golda Meir School (1615 North Martin Luther King Drive) was the name of the institution in which the study took place. In 1972, the elementary school was developed as a gifted and talented program as a movement to integrate public schools with students of different ethnic and cultural backgrounds. In the fall of 2014, the high school opened its doors to its first set of freshman students.

When evaluating the percentage by racial/ethnic background, the school's student population was broken down as such: African-American/Black (57%), Caucasian/White (30%), Hispanic (7%), Asian (4.5%), and American Indian (.4%). The gender split was almost equal, with the female population consisting of 51% and the male population consisting of 49%.

Upon reviewing the economic status of the student population, Golda Meir students were categorized into two different groups: economically disadvantaged (46%) and non-economically disadvantaged (54%). The student population breakdown of students with disabilities (5%) and students without disabilities (95%) was markedly different, with the student population being heavily not identified as special education students.

Data collection took place during school operational hours in the 9th grade mathematics classroom; in students' Algebra classes and during a mathematics intervention period (25 minutes) prior to the end of the school day in the researcher's

resource classroom (Room 314).

Procedures

The study began with students completing an administered survey of mathematical aptitude; the survey was administered in the intervention classroom. Survey questions were read and a brief discussion of the questions was given, in order to provide clarity for the students to respond. Students completed a pretest at the beginning of the study; a posttest was administered at the conclusion of the study. The chief assessment for the study was the TOMA-2 (Brown, Cronin, & McEntire, 1994).

The TOMA-2 was used to measure students' performance in answering mathematical story problems. The questions on the assessment were modeled to identify if students were capable of applying knowledge of mathematical concepts to real-life problems. The assessment gauged students' attitudes towards mathematics and helped measure students' understanding of mathematical vocabulary and students' skill of how to read directions in assigned schoolwork. Assessments were administered individually to students outside of classroom instruction time. Students were given sufficient time to complete assessments, as to not feel rushed.

Over the course of eight weeks, the researcher used mathematics textbooks while modeling for students how to effectively use the strategies of text coding and journal writing during classroom instruction with mathematical word problems.

The reading comprehension strategies of text coding and journal writing were used in the classroom to identify the pertinent information in mathematical word problems. Strategies were also used to assist students to compare, contrast, and interpret data through the use of graphs and tables.

The text coding and journal writing strategies entailed: reading the word problem several times, identifying and recording pertinent information about the problem (known variables and unknown variables) in the math journal, and determining mathematical operation. Next, students solved the problem, created tables, and/or developed graphs based on the type of problem. The use of these strategies helped students apply prior knowledge independently in guided practice. Journal writing helped students keep record of their learned processes and aided in helping students infer from previously learned mathematical concepts.

Students were supported through the process by having strategies taught and modeled in guided practice, and partner practice and independent practice; the progress of the students was recorded in order to assess how the study affected academic achievement. The strategies of text coding and journal writing were ongoing in conjunction with students' regular classroom instruction. Strategies were introduced during the day in class and outside of class. Student attendance records were kept daily, along with summarized notes of individual student progress. At the end of the eight weeks, post-tests were administered to assess student growth. Upon completion of the study, the school received feedback on what affect the reading project had on student reading comprehension in mathematics.

Data included pretests and posttests. Students were administered the Test of Mathematical Abilities – Second Edition (TOMA-2; Brown, Cronin, & McEntire, 1994) at the beginning and the conclusion of the study. TOMA-2 was used to measure students' performance in answering mathematical story problems.

Students were given surveys to complete that were related to their attitude about

the union of using mathematics and literacy strategies concurrently in the classroom. Interviews with students were conducted to gain additional information about the students or to expound upon their survey responses. Records of my observations, field notes, copies of lessons, and samples of student work were kept as additional data to establish the running record of data collection in the study.

Week One and Week Two:

The first two weeks of research occurred from December 1, 2014 through December 13, 2014. During this time period, the nine students involved in the study were administered the TOMA-2 assessment. The testing served as a pre-test assessment in order to analyze the strengths and weaknesses the students possessed in their mathematical abilities when solving problems that include vocabulary, computation, and story problems.

The duration of the testing took place over the course of two weeks in order to give students extended time on the assessment. The students attended mathematics interventions every other day over the course of the study (the students' daily interventions were divided between the contents of math and reading during the week; for example, Monday students met with a reading intervention instructor, and Tuesday students met with a mathematics intervention instructor). The schedule worked well for the study, for six out of the nine students (Student A, Student D, Student E, Student G, Student H, and Student I) required extra time on all assessments as it was written in their IEPs.

Week Three and Week Four:

The third and fourth weeks of the study occurred from December 15 through 19

2014, and January 7-13, 2015. The gap in the study was due to Milwaukee Public Schools being released for holiday break on Friday, December 19, 2014. In the first week, students participated in a text-coding lesson that focused on the interpretation of word problems. After holiday break, the study focused on lessons dealing with learning about graph and table interpretation.

Text Coding Word Problems

Carter and Dean (2006) conducted a study where eight classroom teachers participating in teaching reading strategies to students in a mathematics classroom. The purpose of this was to examine the positive effect that incorporating the instruction of comprehension strategies (such as decoding and vocabulary instruction) in mathematics classrooms has on students' reading comprehension of content specific text. In relation to this research, it was Bach, Bardsley, Brown, and Phillips (2009) that conducted research around the idea that teachers must continue to create structure in their questioning through mathematics text that will help students become deeper thinkers in the material.

Prior to holiday break, the mathematics intervention instructor created a literacy lesson involving word problems. Students were given a continuation of word problems they were already receiving in class and were asked to set up an equation and find the missing value. In an attempt to encourage deeper level critical thinking, the students were asked to sift through the problem and identify all of the important information.

Afterwards, students were asked to share why they found the selected information to be pertinent. Students were then asked to explain to the instructor *what* the word problem was asking, and *which* mathematical operations were being used in the problem. The instructor used this part of the activity to connect the students to the mathematical

language given in the word problem (taxed, spend, costs). To assess students' understanding of the concept, students were asked to review their notes and create their own personal word problems, which the instructor would then attempt to solve. This additional activity assesses students' understanding of the word problem building process.

Graph and Table Interpretation

In a study conducted by Blagdanic and Chinnappan (2013), it was mentioned that students generate thorough explanations of information when it is presented to them using real-life data with visuals, such as graphs and tables. The study conducted with the students at Golda Meir focused on two of the four phases of data interpretation that Blagdanic and Chinnappan researched.

The first phase of focus was Phase 2: *Students picking pertinent information from graphs and applying it to real-life context* (Blagdanic & Chinnappan, 2013). Students were asked to read and study three bar graphs (two vertical and one horizontal) that presented data on two real-world issues: binge drinking by teenagers and adult smoking rates. The second phase of focus was Phase 4: *Students learn to analyze and interpret data deeply through guided questioning* (Blagdanic & Chinnappan, 2013). Students were given questions after studying the information laid out for them in the graphs. The intervention instructor would then give students 5 minutes to answer the questions.

Afterwards, open dialogue took place as students would share their answers and teacher feedback would be offered. The idea behind this activity was for the instructor to observe how well the students were using the text coding practices (modeled in the prior pre-holiday activity) that would help them identify key information (keyword search,

underlining, highlighting, vocabulary recognition).

Week Five:

The fifth week of the study occurred from January 14, 2015 through January 21, 2015. During this week, students participated in a lesson that focused on combining the strategy of coding the text that was read with journaling about the context of the problem before solving. Graham and Hebert (2010) researched that students are more successful in mathematics when they create text while reading as a way to better understand complex text.

In the lesson, students were given word problems and open space to create their personal dialogue to the questions. Students were not asked to provide answers to the questions. However, students were asked to code the text, and write about what they believed the question was asking them to do. If they chose to answer the questions, they had to provide thorough explanations as to how they found the answer, not to simply provide a solution.

Week Six:

The sixth week of the study occurred from January 22, 2015 through January 29, 2015. During this week, students participated in lessons that would integrate math computation skills, coding read text, and writing down steps of the problem solving process. In a study conducted by Monroe and Wilcox (2011), research was presented that students who take notes *get to know* the math and have deeper connections with the content. Internalizing mathematics is a skill students need to possess that will help them draw deeper connections with the material in order to communicate learned information more independently (Monroe & Wilcox, 2011).

This first part of the lesson included one word problem in which students were asked to code the text, notate the steps they thought the problem required to solve the problem, and to work out the problem to the right of the steps they jotted down. This lesson was structured to help students take a deeper look at how they solve problems and to see if they *writing to learn* practices were working effectively (Borasi and Rose, 1989).

The second part of the lesson included two math computation problems that students were learning to solve in the general curriculum classroom (substitution and elimination method systems of equations). Students had to reflect back on their notes from class and journal about the process of the systems presented. The instructor guided them through the lesson by asking guided questions to assist them through the process: *how do we know which method to use, what do we do first when using this method, etc.* After journaling about the steps, students attempted to solve the system using one of the methods.

Week Seven and Week Eight:

The last two weeks of the study occurred from February 2, 2015 through February 13, 2015. During this time period, the nine students involved in the study were administered the TOMA-2 assessment. The testing served as a post-test assessment in order to analyze the strengths and weaknesses the students possessed at the closing of the academic study in which they participated. As stated before, the study focused on the analysis of students' mathematical abilities when solving problems that include vocabulary, computation, and story problems.

The duration of the testing took place over the course of two weeks in order to give students extended time on the assessment; six out of the nine students (Student A,

Student D, Student E, Student G, Student H, and Student I) required extra time on all assessments as it was written in their IEPs, as stated prior in this chapter.

Conclusion

This chapter contained background information on all students that participated in the study. Student academic levels and IEP categories were described in order identify specific student needs, and to more properly inform the research that took place during the two-month intervention. All students were assessed with the same norm-referenced assessment (TOMA-2) and received the same interventions every other instructional day. In the next chapter, results of the pre-test and the post-test will be presented in order to evaluate the strengths and weaknesses of all students involved in the study. Results of the interventions will also be reported to present a clearer idea of which students benefited from the practices.

Chapter 4

Results

This chapter contains the detailed results of the pre-tests and the post-tests conducted on the students involved in the research activity. The assessments included subtests of vocabulary, computation, general information, and story problems. The results from the pre-test helped inform the researcher as to what interventions needed to take place in order to design effective mathematical interventions. The data presented in this chapter was collected over two months (December 2014 through February 2015); the student participants were in two groups that were seen every other day for 30-minute sessions.

Week One – Week Two: TOMA-2 Pre-Test

The first two weeks of the study started with the researcher administering the Test of Mathematical Abilities Second Edition (TOMA-2) to the student participants. The TOMA-2 is a norm-referenced assessment that served multiple purposes: 1) it identified students who were below their peers and required supplemental intervention, 2) determined strengths and weaknesses of all participants, 3) provided methods of intervention for participants, and 4) provided the researcher with an adequate measure to assess students (Brown, Cronin, & McEntire, 1994). The assessment was administered to nine students before the first intervention took place. The following sections break down the results of the subtests taken by students: vocabulary, computation, general information, and story problems. The sections include tables that display the pre-test scores of the students involved in the study.

Vocabulary

The first subtest administered to students was the vocabulary section of the TOMA-2. The test listed 25 vocabulary words and asked students to give their best definition for the given word. Examples of some of the terms listed were *volume, prime meridian, ratio, and calendar*. Students who scored a perfect raw score of 25 were considered “Very Superior” in comparison with their peers (Brown, Cronin, & McEntire, 1994). In this study, not one student tested at the aforementioned level. In Figure 1.1, the data displayed how students in the study measured up with one another on defining the given vocabulary.

Student A

Student A answered three out of the first six questions correctly, mastering terms such as *fraction, half, and equals*. However, he struggled with identifying a range of items from *dozen, Celsius, kilometer, and ounce*. He reached his peak at three correct answers, for he earned three consecutive incorrect responses. Brown, Cronin, and McEntire called this scoring component “reaching your ceiling”, which students are required to discontinue testing (1994).

His score was at the 25th percentile, indicating that 25 percent of the standardization sample at his age of 14.9 years scored at or below the raw score of 3 (Brown, Cronin, & McEntire, 1994). The score reflected that Student A’s vocabulary acquisition was at an Average level compared with other students his age.

Student B

Student B answered 12 out of the first 20 questions correctly, mastering terms such as *kilometer, volume, and probability*. However, she struggled with identifying a

range of items from *fraction, Celsius, perimeter, and hypotenuse*. She reached her peak at question 22, where she reached her ceiling.

Her score was at the 84th percentile, indicating that 84 percent of the standardization sample at her age of 15.01 years scored at or below the raw score of 12 (Brown, Cronin, & McEntire, 1994). The score reflected that Student B's vocabulary acquisition was at an Above Average level compared with other students her age.

Student C

Student C answered seven out of the first ten questions correctly, mastering terms such as *decimal, ounce, and fraction*. However, he struggled with identifying a range of items from *volume, Celsius, kilometer, and exponent*. He reached his peak at question 13, which is where he reached his ceiling.

His score was at the 63rd percentile, indicating that 63 percent of the standardization sample at his age of 15.11 years scored at or below the raw score of 7 (Brown, Cronin, & McEntire, 1994). The score reflected that Student C's vocabulary acquisition was at an Average level compared with other students his age.

Student D

Student D answered five out of the first seven questions correctly, mastering terms such as *dozen, Celsius, and ounce*. However, she struggled with identifying a range of items from *calendar, kilometer, perimeter, and decimal*. She reached her peak at question 10, where she reached her ceiling.

Her score was at the 25th percentile, indicating that 25 percent of the standardization sample at her age of 16.00 years scored at or below the raw score of 5

(Brown, Cronin, & McEntire, 1994). The score reflected that Student D's vocabulary acquisition was at an Average level compared with other students her age.

Student E

Student E answered two out of the first three questions correctly, mastering terms such as *dozen and equals*. However, he struggled with identifying a range of items from *calendar, fraction, and half*. He reached his peak at question seven, where he reached his ceiling.

His score was at the 16th percentile, indicating that 16 percent of the standardization sample at his age of 14.07 years scored at or below the raw score of 2 (Brown, Cronin, & McEntire, 1994). The score reflected that Student E's vocabulary acquisition was at a Below Average level compared with other students his age.

Student F

Student F answered seven out of the first eight questions correctly, mastering terms such as *dozen, Celsius, and ounce*. However, he struggled with identifying a range of items from *volume, kilometer, and decimal*. He reached his peak at question 10, where he reached his ceiling.

His score was at the 63rd percentile, indicating that 63 percent of the standardization sample at his age of 14.11 years scored at or below the raw score of 7 (Brown, Cronin, & McEntire, 1994). The score reflected that Student F's vocabulary acquisition was at an Average level compared with other students his age.

Student G

Student G answered three out of the first five questions correctly, mastering terms such as *equals, Celsius, and fraction*. However, she struggled with identifying a range of

items from *calendar*, *dozen*, and *volume*. She reached her peak at question 8, where she reached her ceiling.

Her score was at the 16th percentile, indicating that 16 percent of the standardization sample at her age of 15.07 years scored at or below the raw score of 3 (Brown, Cronin, & McEntire, 1994). The score reflected that Student G's vocabulary acquisition was at a Below Average level compared with other students her age.

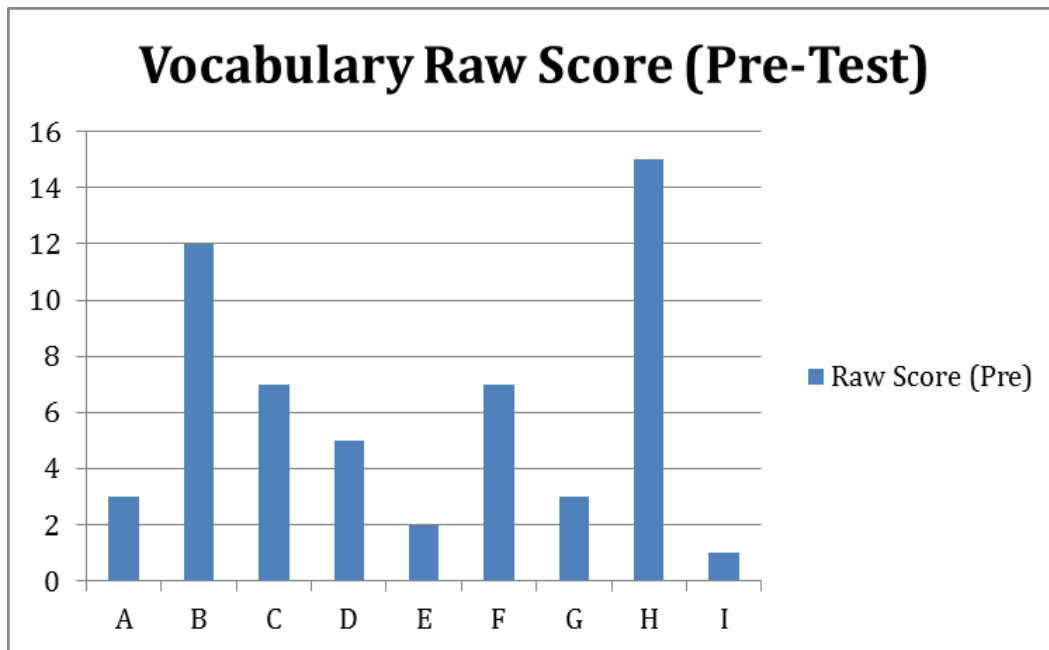
Student H

Student H answered 15 out of the first 20 questions correctly, mastering terms such as *pi*, *quadrilateral*, *coordinates*, and *prime meridian*. However, he struggled with identifying a range of items from *hypotenuse*, *perimeter*, and *binomial*. He reached his peak at question 23, where he reached his ceiling.

His score was at the 95th percentile, indicating that 95 percent of the standardization sample at his age of 14.10 years scored at or below the raw score of 15 (Brown, Cronin, & McEntire, 1994). The score reflected that Student H's vocabulary acquisition was at a Superior level compared with other students his age.

Student I

Student I answered one out of the first three questions correctly, only defining equals. He struggled with every term afterwards, peaking at question 5, where he reached his ceiling. His score was at the 5th percentile, indicating that 5 percent of the standardization sample at his age of 15.03 years scored at or below the raw score of 1 (Brown, Cronin, & McEntire, 1994). The score reflected that Student I's vocabulary acquisition was at a Poor level compared with other students his age.

Figure 1.1: TOMA Vocabulary Pre-Test - December 2014

Computation

The second subtest administered to students was the computations section of the TOMA-2. The test included 25 items that measured students' ability to solve a variety of arithmetic problems. Questions included one-step equations, scientific notation, geometry, probability, percent, and fractions. Students who scored a perfect raw score of 30 were considered "Very Superior" in comparison with their peers (Brown, Cronin, & McEntire, 1994). In this study, not one student tested at the aforementioned level. In Figure 1.2, the data displayed how students in the study measured up with one another from answering the given questions.

Student A

Student A answered 16 out of the first 24 questions correctly, mastering items such as multi-digit addition and subtraction. However, he struggled with the concepts of fractions, calculating percentages, and performing arithmetic with decimals. He also struggled with long division. He reached his peak at question 27, where he reached his ceiling.

His score was at the 16th percentile, indicating that 16 percent of the standardization sample at his age of 14.9 years scored at or below the raw score of 16 (Brown, Cronin, & McEntire, 1994). The score reflected that Student A's computation skills were at a Below Average level compared with other students his age.

Student B

Student B answered 20 out of the first 23 questions correctly, mastering items such as long division, multi-digit arithmetic, and adding and subtracting with decimals. However, she struggled with adding, subtracting, multiplying, and dividing fractions. She reached her peak at question 26, where she reached her ceiling.

Her score was at the 50th percentile, indicating that 50 percent of the standardization sample at her age of 15.01 years scored at or below the raw score of 20 (Brown, Cronin, & McEntire, 1994). The score reflected that Student B's computation skills were at an Average level compared with other students her age.

Student C

Student C answered 21 out of the first 27 questions correctly, mastering items such as simple geometry, multiplying fractions, long division, and the properties of exponents. However, he struggled with the concepts of adding with decimals, ratio,

calculating percentages, and dividing mixed number fractions. He reached his peak at question 30, which is where he reached his ceiling.

His score was at the 50th percentile, indicating that 50 percent of the standardization sample at his age of 15.11 years scored at or below the raw score of 21 (Brown, Cronin, & McEntire, 1994). The score reflected that Student C's computation skills were at an Average level compared with other students his age.

Student D

Student D answered 20 out of the first 26 questions correctly, mastering items such as multiplying and dividing fractions, and adding and subtracting multi-digit numbers. However, she struggled with the concepts of calculating percentages, factoring, and ratios. She reached her peak at question 29, where she reached her ceiling.

Her score was at the 37th percentile, indicating that 37 percent of the standardization sample at her age of 16.00 years scored at or below the raw score of 20 (Brown, Cronin, & McEntire, 1994). The score reflected that Student D's computations skills were at an Average level compared with other students her age.

Student E

Student E answered 18 out of the first 19 questions correctly, mastering items such as adding and subtracting multi-digit numbers, and adding and subtracting with decimals. However, he struggled with the concepts of calculating percentages, properties of exponents, ratios, and multiplying and dividing fractions. He reached his peak at question 22, where he reached his ceiling.

His score was at the 37th percentile, indicating that 37 percent of the standardization sample at his age of 14.07 years scored at or below the raw score of 37

(Brown, Cronin, & McEntire, 1994). The score reflected that Student E's computation skills were at an Average level compared with other students his age.

Student F

Student F answered 18 out of the first 24 questions correctly, mastering items such as arithmetic with multi-digit numbers, evaluating exponents, and performing arithmetic with negative numbers. However, he struggled with the concepts of adding, subtracting, and multiplying fractions, factoring, simple geometry, and calculating. He reached his peak at question 24, where he reached his ceiling.

His score was at the 37th percentile, indicating that 37 percent of the standardization sample at his age of 14.11 years scored at or below the raw score of 18 (Brown, Cronin, & McEntire, 1994). The score reflected that Student F's computation skills were at an Average level compared with other students his age.

Student G

Student G answered 22 out of the first 26 questions correctly, mastering items such as arithmetic with multi-digit numbers, multiplying and dividing fractions, and long division. However, she struggled with the concepts of calculating percentages, simple geometry, and factoring. She reached her peak at question 29, where she reached her ceiling.

Her score was at the 63rd percentile, indicating that 63 percent of the standardization sample at her age of 15.07 years scored at or below the raw score of 22 (Brown, Cronin, & McEntire, 1994). The score reflected that Student G's computation skills were at an Average level compared with other students her age.

Student H

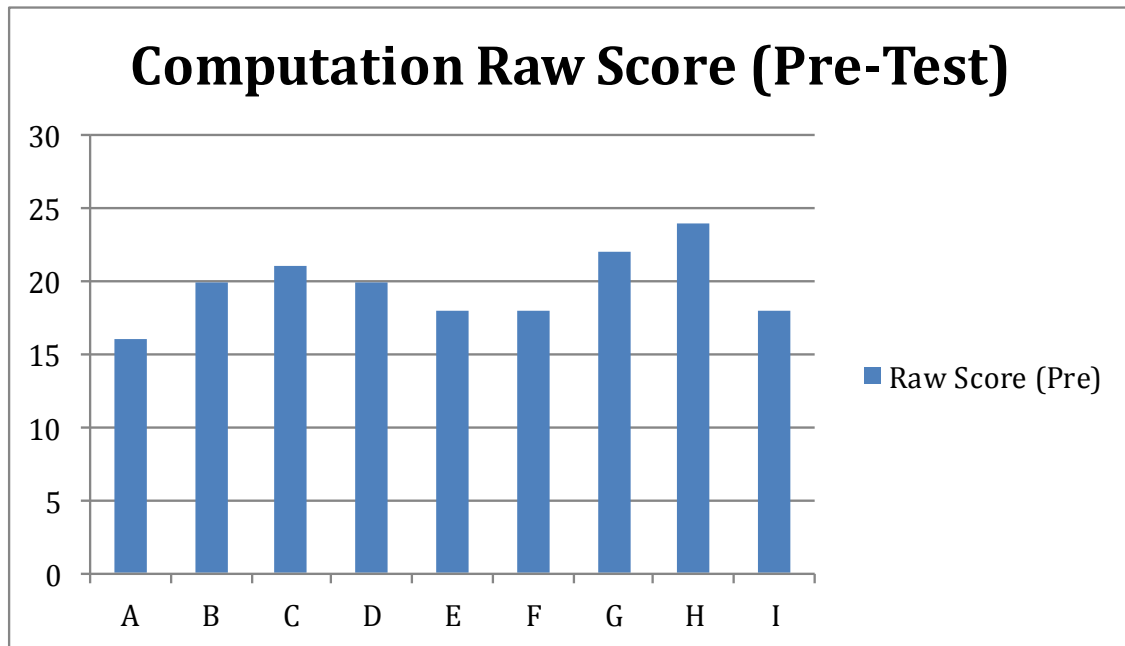
Student H answered 24 out of the first 26 questions correctly, mastering items such as adding and subtracting fractions, multi-digit arithmetic, simple geometry, and multiplying and dividing fractions. However, he struggled with the concepts of scientific notation, calculating percentages, factoring, and long division. He reached his peak at question 29, where he reached his ceiling.

His score was at the 84th percentile, indicating that 84 percent of the standardization sample at his age of 14.10 years scored at or below the raw score of 24 (Brown, Cronin, & McEntire, 1994). The score reflected that Student H's computation skills were at an Above Average level compared with other students his age.

Student I

Student I answered 18 out of the first 21 questions correctly, mastering items such as multi-digit arithmetic, and adding and subtracting with decimals. However, he struggled with the concepts of adding and subtracting fractions, multiplying and dividing fractions, calculating percentages, factoring, calculating square roots, and simple geometry. He reached his peak at question 21, where he reached his ceiling.

His score was at the 25th percentile, indicating that 25 percent of the standardization sample at his age of 15.03 years scored at or below the raw score of 18 (Brown, Cronin, & McEntire, 1994). The score reflected that Student I's computation skills were at an Average level compared with other students his age.

Figure 1.2: TOMA Computation Pre-Test - December 2014

General Information

The third subtest administered to students was the general information section of the TOMA-2. The researcher read 30 questions to students who replied by writing responses to the questions. The questions in the subtest dealt with measuring students' general knowledge of mathematics used in everyday situations (Brown, Cronin, & McEntire, 1994). Questions included items such as: *How many pennies are in a dime? What do the terms dollars, pesos, pounds, and yen have in common? What does the phrase double or nothing mean?* Students who scored a perfect raw score of 30 were considered "Very Superior" in comparison with their peers (Brown, Cronin, & McEntire, 1994). In this study, not one student tested at the aforementioned level. In Figure 1.3, the data displayed how students in the study measured up with one another through identification of real-world mathematics.

Student A

Student A answered 12 out of 30 questions correctly. His score was at the 9th percentile, indicating that 9 percent of the standardization sample at his age of 14.9 years scored at or below the raw score of 12 (Brown, Cronin, & McEntire, 1994). The score reflected that Student A's general knowledge of real-world mathematics was at a Below Average level compared with other students his age.

Student B

Student B answered 15 out of 30 questions correctly. Her score was at the 9th percentile, indicating that 9 percent of the standardization sample at her age of 15.01 years scored at or below the raw score of 15 (Brown, Cronin, & McEntire, 1994). The score reflected that Student B's general knowledge of real-world mathematics was at a Below Average level compared with other students her age

Student C

Student C answered 18 out of 30 questions correctly. His score was at the 25th percentile, indicating that 25 percent of the standardization sample at his age of 15.11 years scored at or below the raw score of 18 (Brown, Cronin, & McEntire, 1994). The score reflected that Student C's general knowledge of real-world mathematics was at an Average level compared with other students his age

Student D

Student D answered 16 out of the first 30 questions correctly. Her score was at the 9th percentile, indicating that 9 percent of the standardization sample at her age of 16.00 years scored at or below the raw score of 16 (Brown, Cronin, & McEntire, 1994).

The score reflected that Student D's general knowledge of real-world mathematics was at a Below Average level compared with other students her age.

Student E

Student E answered 11 out of the first 30 questions correctly. His score was at the 9th percentile, indicating that 9 percent of the standardization sample at his age of 14.07 years scored at or below the raw score of 11 (Brown, Cronin, & McEntire, 1994). The score reflected that Student E's general knowledge of real-world mathematics was at a Below Average level compared with other students his age.

Student F

Student F answered 16 out of the first 30 questions correctly. His score was at the 25th percentile, indicating that 25 percent of the standardization sample at his age of 14.11 years scored at or below the raw score of 16 (Brown, Cronin, & McEntire, 1994). The score reflected that Student F's general knowledge of real-world mathematics was at an Average level compared with other students his age.

Student G

Student G answered 7 out of the first 30 questions correctly. Her score was at the 2nd percentile, indicating that 2 percent of the standardization sample at her age of 15.07 years scored at or below the raw score of 7 (Brown, Cronin, & McEntire, 1994). The score reflected that Student G's general knowledge of real-world mathematics was at a Poor level compared with other students her age.

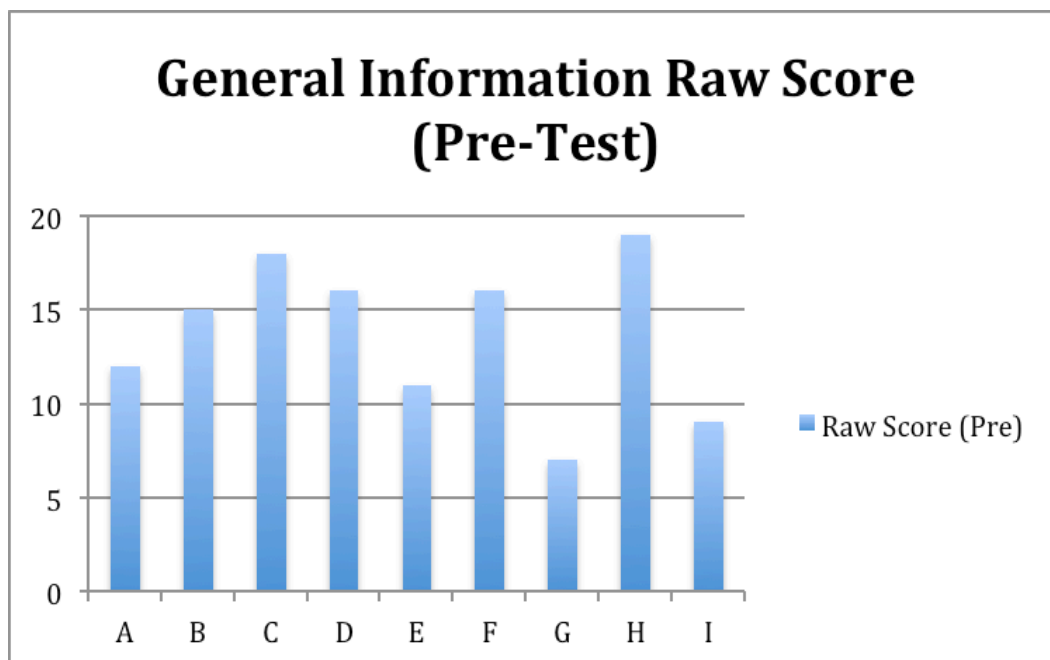
Student H

Student H answered 19 out of the first 30 questions correctly. His score was at the 37th percentile, indicating that 37 percent of the standardization sample at his age of 14.10 years scored at or below the raw score of 19 (Brown, Cronin, & McEntire, 1994). The score reflected that Student H's general knowledge of real-world mathematics was at an Average level compared with other students his age.

Student I

Student I answered 9 out of the first 30 questions correctly. His score was at the 2nd percentile, indicating that 2 percent of the standardization sample at his age of 15.03 years scored at or below the raw score of 9 (Brown, Cronin, & McEntire, 1994). The score reflected that Student I's general knowledge of real-world mathematics was at a Poor level compared with other students his age.

Figure 1.3: TOMA General Information Pre-Test - December 2014



Story Problems

The fourth subtest administered to students was the story problems section of the TOMA-2. The test included 25 problems that were presented as word problems. Students were asked to read each question and solve them accordingly. Questions ranged from easy to solve, to difficult/challenging to solve. The easy questions could have possibly been confidence builders for students to get engaged with the questions. Students who scored a perfect raw score of 25 were considered “Very Superior” in comparison with their peers (Brown, Cronin, & McEntire, 1994). In this study, not one student tested at the aforementioned level. In Table 1.4, the data displayed how students in the study measured up with one another on solving word problems.

Student A

Student A answered one out of the first four questions correctly. He reached his ceiling at question four. It was found that he struggled with problems that included extra no-pertinent information. He also struggled to understand what the question was asking exactly, providing answers that were on the right track, but not fully correct.

His score was less than that of the 1st percentile, indicating that only less than one percent of the standardization sample at his age of 14.9 years scored at or below the raw score of 1 (Brown, Cronin, & McEntire, 1994). The score reflected that Student A’s skills at solving word problems were Very Poor compared with other students his age.

Student B

Student B answered three out of the first four questions correctly. She reached her ceiling at question six. Unfortunately, Student B arrived to class late during

intervention and could not go any further during this portion of the assessment, potentially decreasing her score.

Her score was at the 1st percentile, indicating that one percent of the standardization sample at her age of 15.01 years scored at or below the raw score of 3 (Brown, Cronin, & McEntire, 1994). The score reflected that Student B's skills at solving word problems were Very Poor compared with other students her age.

Student C

Student C answered 12 out of the first 13 questions correctly. He reached his ceiling at question 16. His strengths included identifying the correct mathematical operation to use when using the information to solve the problems. Weaknesses included applying knowledge of fractions and probability in the word problem solving area.

His score was at the 50th percentile, indicating that 50 percent of the standardization sample at his age of 15.11 years scored at or below the raw score of 12 (Brown, Cronin, & McEntire, 1994). The score reflected that Student C's word problem skills were at an Average level compared with other students his age.

Student D

Student D answered eight out of the first nine questions correctly. She reached her ceiling at question 12. Strengths of her word problem solving skills included picking the pertinent information to solve a simple trial and error word problem. Weaknesses she possessed were not being able to identify the proper mathematical operation to use to solve a question, and applying knowledge of probability to certain word problems.

Her score was at the 16th percentile, indicating that 16 percent of the standardization sample at her age of 16.00 years scored at or below the raw score of 8

(Brown, Cronin, & McEntire, 1994). The score reflected that Student D's word problem solving skills were at a Below Average level compared with other students her age.

Student E

Student E answered three out of the first six questions correctly. He reached his ceiling at question 8. He struggled to use reading skills that could help him pick the pertinent information from the writing. He answered questions based on the basic information provided to him, without trying to decipher what the question was really asking.

His score was at the 2nd percentile, indicating that 2 percent of the standardization sample at his age of 14.07 years scored at or below the raw score of 3 (Brown, Cronin, & McEntire, 1994). The score reflected that Student E's word problem solving skills were at a Poor level compared with other students his age.

Student F

Student F answered 12 out of the first 14 questions correctly. He reached his ceiling at question 17. His strengths included identifying the proper mathematical operations to use when solving questions in the problems, and applying knowledge of fractions when solving questions. However, he struggled with questions dealing with probability and building equations that dealt with currency.

His score was at the 63rd percentile, indicating that 63 percent of the standardization sample at his age of 14.11 years scored at or below the raw score of 12 (Brown, Cronin, & McEntire, 1994). The score reflected that Student F's word problem solving skills were at an Average level compared with other students his age.

Student G

Student G answered two out of the first three questions correctly. She reached her ceiling at question 6. She struggled with picking the pertinent information from the word problem, and choosing the proper mathematical operations to use when solving questions. Her mathematical process tended to be very complex and unnecessary for simple questions.

Her score was less than the 1st percentile, indicating that less than 1 percent of the standardization sample at her age of 15.07 years scored at or below the raw score of 2 (Brown, Cronin, & McEntire, 1994). The score reflected that Student G's word problems solving skills were Very Poor compared with other students her age.

Student H

Student H answered five out of the first six questions correctly. He reached his ceiling at question 9. His strengths included using probability to answer questions and picking the pertinent information after reading the word problem. He struggled to complete the subtest, as he often takes a lot of time over thinking and not solving questions.

His score was at the 5th percentile, indicating that 5 percent of the standardization sample at his age of 14.10 years scored at or below the raw score of 5 (Brown, Cronin, & McEntire, 1994). The score reflected that Student H's word problem solving skills were at a Poor level compared with other students his age.

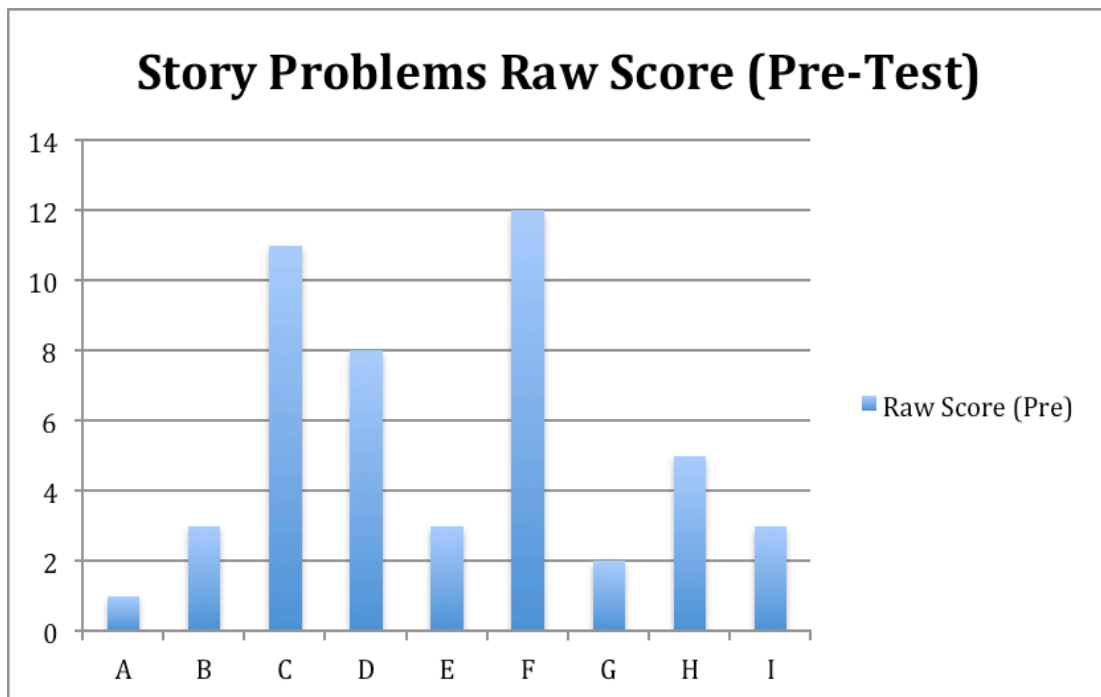
Student I

Student I answered three out of the first five questions correctly. He reached his ceiling at question 7. His strengths included using probability to answer questions and

picking some pertinent information after reading the word problem. He struggled to complete the subtest, as he often became frustrated with the test, not wanting to complete it. This behavior was reflective of his normal test taking behaviors for his core curriculum classes.

His score was at the 1st percentile, indicating that 1 percent of the standardization sample at his age of 14.10 years scored at or below the raw score of 3 (Brown, Cronin, & McEntire, 1994). The score reflected that Student I's word problem solving skills were at a Very Poor level compared with other students his age.

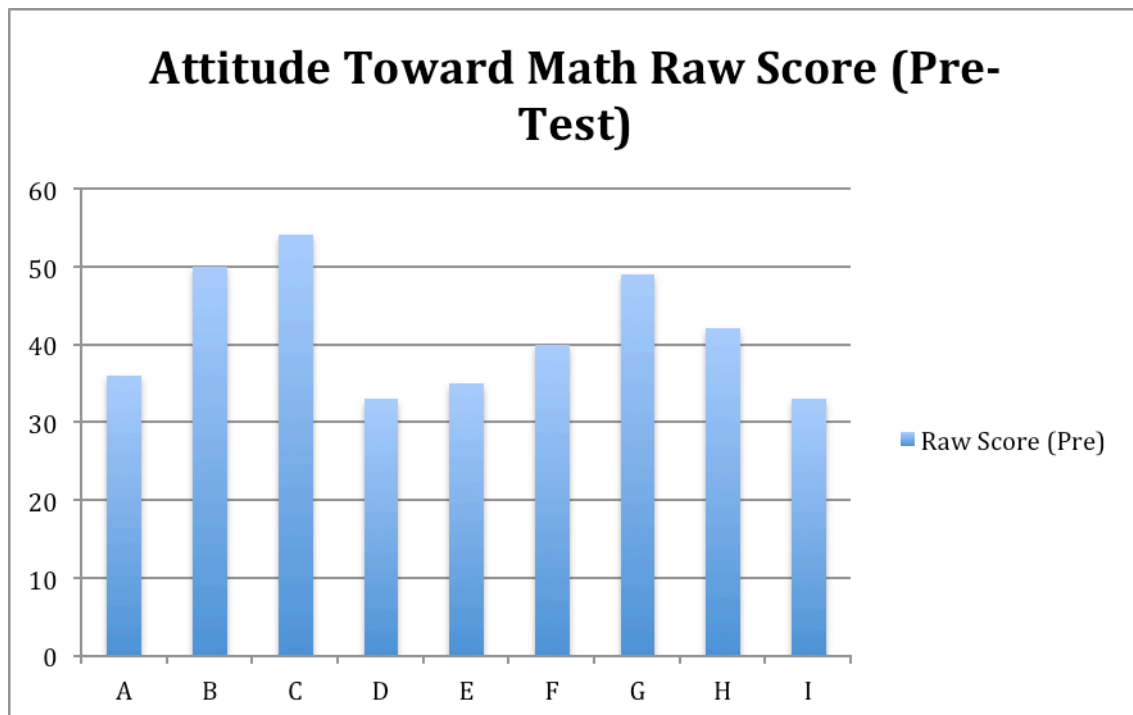
Figure 1.4: TOMA Story Problems Pre-Test - December 2014



Attitude Toward Math

The fifth subtest administered to students was the survey that measured the students' overall attitude towards math. The test included 15 statements that students responded to from a range of 1 through 4. Responses were: “*yes, definitely*”, “*closer to yes*”, “*closer to no*”, and “*no, definitely*”. This section of the assessment was used to measure how students personally felt about their mathematical abilities. Students who responded with a perfect raw score of 60 were considered to be very confident in their abilities. (Brown, Cronin, & McEntire, 1994). In this study, not one student tested at the aforementioned level. In Figure 1.5, the data displayed how students in the study measured up with one another.

Figure 1.5: TOMA Attitude Toward Math Pre-Test - December 2014

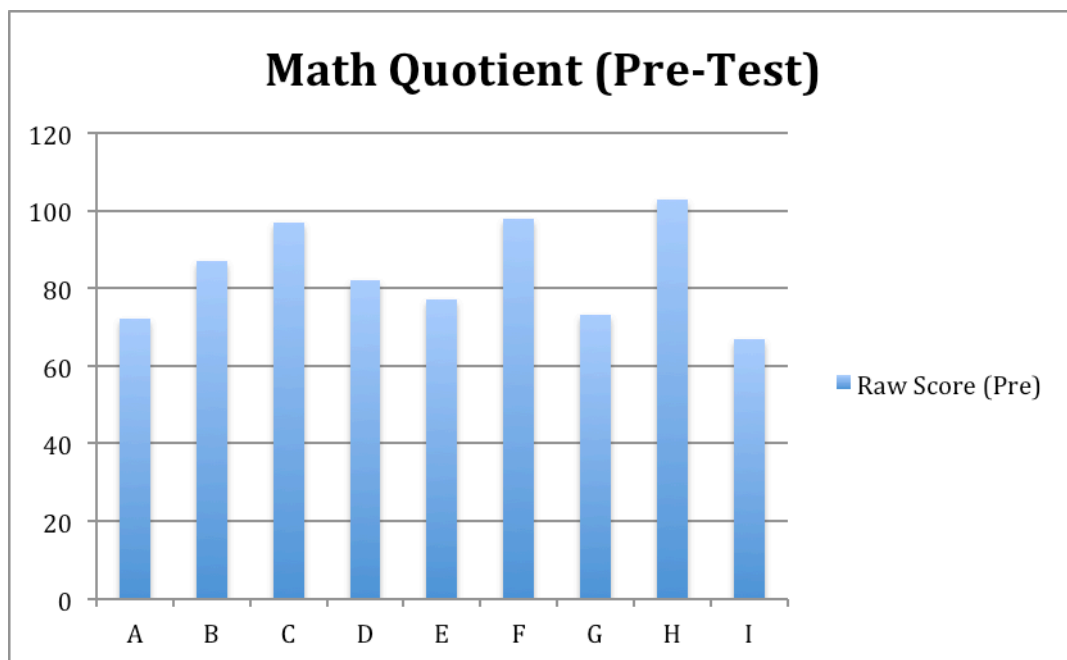


Math Quotient

The table was a measure of the students' composite "math ability" (Brown, Cronin, & McEntire, 1994). This item, called the Math Quotient, examined the overall mathematical competency of the students involved in the study. Students with a considerable amount of knowledge about the use of math scored higher on the assessment, which was then taken into account with the Math Quotient.

Brown, Cronin, and McEntire (1994) implied that students who earned low scores were considered to be students who possessed a higher need of mathematics intervention due to their intellectual impairment with mathematical material. The researchers shared that when the quotient reaches below 90, teachers should pay closer attention to their students' performance on the different subtests in order to pinpoint where areas of struggle are apparent (1994). In Figure 1.6, the data displayed how students in the study measured up with one another.

Figure 1.6: TOMA Math Quotient Pre-Test - December 2014



Week Three – Week Four

The third and fourth weeks of the study occurred from December 15 through 19 2014, and January 7-13, 2015. The gap in the study was due to Milwaukee Public Schools being released for holiday break on Friday, December 19, 2014. Week three was set up for students to participate in a text-coding lesson that focused on the interpretation of word problems. Week four was set up for students to focus on lessons dealing with learning about graph and table interpretation. The purpose of this was to examine the positive effect that incorporating the instruction of comprehension strategies (such as decoding and vocabulary instruction) in mathematics classrooms has on students' reading comprehension of content specific text.

Text Coding

Students were given a word problem and charged with the task of solving for a missing value by using the given information in the word problem. The problem involved figuring out the remaining money left over from Christmas shopping. The problem included pertinent information the student had to pull: number of items purchased (two items purchased – \$75 and \$66 – and one left to purchase), sales tax (8%), and money budgeted for spending (\$200). Students were charged with setting up an equation to find the money left over for purchasing the third gift. The lesson also gave the students guiding questions to help them think about how the problem should be solved: 1) “*What is the word problem asking me to do?*”, 2) “*What mathematical operations am I using in this problem?*”, and 3) “*Do you know how to set this problem up to be solved? If so, how?*”

Student A struggled to answer question 1 independently. He did not write any

response to the question down and only jotted notes down as the teacher guided students through the question after they were instructed to practice it independently. However, he was able to list the mathematical operations used to answer the problem. His paper also lacked any evidence that he understood how to code the text. He did not underline, highlight, or pick out any pertinent information to help solve.

Student B not only answered all three questions, but her answers were the closest to being correct. For question #1, she was able to interpret that the cost of the third person's gift was the question being asked. She also could list in order which mathematical operations were being used to solve the problem. Her setup for the third question was so close to being correct: $200 = (75 + 66) (.08) + (75 + 66) + x$ was the correct setup. Student B wrote $200 = (75 + 66) (.08) + x$ instead. Her paper also included underlining of specific words such as spend, purchased, and taxed. She also made sure she underlined the numbers given in the word problem.

Student C answered the questions 100 percent correctly, and also used a coding strategy that was being used in the students' Physics class: a note-taking strategy called *G.U.E.S.S.* The "G" stood for given information, the "U" stood for unknown information, the "E" stood for equation to use, the "S" stood for solve the problem, and the "S" stood for solution to the problem. He coded all the information using this format instead of other taught strategies and was able to answer all the given questions correctly.

Student D only answered the first two questions. The first one she answered correctly, using the keyword *left* as a way to code the text and pick out pertinent information. Her setup for question #2 used the proper process until she did not add her calculated tax with the price of the two gifts combined. Her text was not coded upon

observation and no answer was given.

Student E only answered the first two questions. The first question was answered correctly, while the second question excluded some key information, such as more than one mathematical operation and what to do with the calculated tax and prices of the first set of gifts. However, he did code his worksheet. All numbers with dollar signs were circled, while the words *left* and *spend* were underlined.

Student F answered all three questions, with the first two being the closest to correct. To help set up the problem, he included the coded text (circled numbers) in his answer to the second question. It seemed as if he was trying to clearly organize the equation for the third question. His equation was very close to correct, though he excluded adding the tax to the original two gift price amounts.

Student G answered the questions correctly (with some guidance from the teacher), while using the same coding strategy that Student C used from Physics class: a note-taking strategy called *G.U.E.S.S.* She coded certain information (the key numbers) but not all of it. Through the coding, she was able to create the correct equations to solve the problems.

Student H attempted to code a portion of the text, not all, but did not complete any of the questions. He was given the same amount of time to complete the questions, but chose not to offer any simple answers to the problems.

Student I worked with Student C and Student G by using the same *G.U.E.S.S.* method that was used in their Physics class. However, he did not attempt to code the text given to him in the problem. He did complete the first problem, but with assistance from his peers.

To assess students' understanding of the coding concept, their progress for this intervention is reflected in the table below. The table showed how students fared overall in the activity, with or without coding the text.

Table 1.1*Text Coding Word Problems*

Question Answered	#1	#2	#3	Did Student Code Text (Y/N)
A	-	√	-	N
B	√	√	√	Y
C	√	√	√	Y
D	√	-	-	N
E	√	-	-	Y
F	√	√	√	Y
G	√	√	√	Y
H	-	-	-	N
I	√	-	-	N
	77.00%	55.00%	44.00%	55.00%

Graph and Table Interpretation

Students were given a two-sided worksheet with two clustered bar graphs and a set of three questions for each graph. Students were asked to read all the information given in the graph (title, axes, subtitles, keys, etc.) in order to prepare them for solving the questions asked in the problem. Page one focused on students analyzing the real world problem of teenage binge drinking from the year 1991 to 2004. Students were asked to analyze the percentage of students who were drinking in the grades of 8th grade, 10th grade, and 12th grade. The questions were as follows: 1) *what was the percent decrease of binge drinkers for 8th graders over the years 1991-2004*, 2) *354 students participated in the study of 12th graders in 2004. How many of those students were considered binge drinkers*, and 3) *in the 2008 study of 12th graders, 94 out of 327 were*

considered binge drinkers by the study. What percent did that represent?

Page two focused on analyzing the real world problem of adult smoking rates from the year 1965 to 2003. Students were asked to analyze the graph's breakdown of males, females, and overall population. The graph also included the subtopics of "States with most regular smokers among adults" and "States with least regular smokers among adults". The questions students were asked to answer were as follows: 1) *write two complete sentences that summarize the information conveyed in the graph*, 2) *why would the states of Kentucky, West Virginia, Tennessee and Oklahoma lead the nation in adult smokers*, and 3) *the graph conveys information relevant up to 2003. What would these statistics look like if the graph were to convey information current to 2013?*

The second question was highly sought to link the relationship between mathematics, English, and history. However, the researcher did not include the question in the data collection for it lacked the necessary mathematics component the research was aiming to discuss.

Student A answered question 1 correctly and independently. He coded the pertinent text on the worksheet (*decrease, 13 year period*). One important note is that he replaced the word *decrease* with *subtraction* after coding the text, showing that he knew which mathematical operation to use in the problem. On question 2, he fared a little differently. He did show any evidence of completing this work independently, only providing an answer. On question 3, Student A was knowledgeable of how to set up a cross multiplication problem to solve the question being asked. He coded the terms such as *out of* to set up a fraction.

Student B answered question 1 correctly and independently. She coded the text and replaced keywords with familiar mathematical terms just as Student A did. On question 2, she understood that she had to seek out the percentage in the graph and use it to set up a cross multiplication problem to solve the question. All of her work was correct and well thought out. On question 3, she correctly identified in the text that she needed to search out information from the year 2008, and properly set up a cross multiplication problem to solve the question.

Student C did not exhibit any coding of the text, but showed he understood that he had to use the graph to solve question 1. His answer was correct, but lacked evidence that he set up the problem correctly. His answer to question 2 was slightly incorrect. Upon review, he did not code the text for better understanding. The pertinent information was not identified, which made the graph and its information a barrier to solving the problem. On question 3, his answer was correct, but lacked evidence that he was aware to set up the problem properly.

Student E answered question 1 and 3 correctly, but without coding any of the given information from the graph or word problems. He also worked in partnership with another student (Student G). Student G answered the same questions correctly. She was aware that she had to look at the graph's information from the years 1991 – 2004 for the 8th graders. She and Student E worked together to come up with the problem setup for question 3.

Student I answered question 1 correctly while included some underlining of the text, showing he understood what he was looking for in the graph. However, though his answers for question 2 and question 3 were correct, it was evident that he was asking

other students for the answers, for he arrived to the intervention tardy.

The students who were absent from this instructed intervention were Student D, Student F, and Student H. Multiple attempts were made to have them complete the assignment, but to no avail were they able to participate in the week's intervention.

To assess students' understanding of interpreting information from graphs, their progress for this intervention is reflected in the table below. The table showed how students fared overall in the activity, with or without coding the text.

Table 1.2
Graph Interpretation Word Problems

Question Answered	#1	#2	#3	Did Student Code Text (Y/N)
A	√	√	√	Y
B	√	√	√	Y
C	√	-	√	N
E	√	-	√	N
G	√	-	√	Y
I	√	√	√	N
	100.00%	50.00%	100.00%	50.00%

Week Five

The fifth week of the study occurred from January 14, 2015 through January 21, 2015. During this week, students participated in a lesson that focused on combining the strategy of coding the text that was read with journaling about the context of the problem before solving. Graham and Hebert (2010) researched that students are more successful in mathematics when they create text while reading as a way to better understand complex text.

In the lesson, students were given word problems and open space to create their personal dialogue to the questions. Students were not asked to provide answers to the

questions. However, students were asked to code the text, and write about what they believed the question was asking them to do. If they chose to answer the questions, they had to provide thorough explanations as to how they found the answer, not to simply provide a solution.

Question 1 was a probability problem that asked students to consider the pertinent information (*52 card deck, four suits*) given to them in order to solve the question within. Question 2 was a conversion problem that required students to be knowledgeable about fractions, decimals, and multiplication.

Student C exhibited strength in identifying the pertinent information; such as the number 52 and how many suits were in the deck. He understood that the question was asking him to give the probability of one card being picked diamond. He provided reasoning for colors being picked (50 – 50 chance) and understood the probability was 1 to 4 for diamonds. For the second question, he understood that the question was asking him about *blood weight* and not *water weight*. He took the given information, deciphered the question and used what was necessary to solve the question correctly.

Student D exhibited strength identifying information while coding the first question with underlining of the number 52 and circling the words *four suits*. She answered the question correctly and understood the concept of probability. For the second question, her coding was not accurate with what the question was asking her to solve for. She allowed the extra unnecessary information to trip her up, which led to inaccurate journaling of how to solve the problem.

Student E did not code the text to help guide his thought process through answering this question. He however did present great logical explanation the question

that was posed. He was one of three students who actually provided an accurate word for word explanation as to what the question was asking. For the second question, he provided solid knowledge of converting the fraction to a decimal and multiplying it to the given number to find the unknown. Though his answer was correct numerically, there was no evidence that he knew how to present the answer through an explanation.

Student F did code the text properly and present an explanation to the question that was posed; he was the second student to do so. For the second question, he coded the correct information required to solve the question. However, his answer only provided the numerical information without an explanation to how he solved it and what he found.

Student G coded the text properly and provided a semi-correct answer to the question. Instead of presenting the reduced fraction of *1 out 4*, she provided *13 out 52*. She also did not provide a correct explanation to how she solved the question. For the second question, she did provide a thorough explanation to what the answer to the question was. However, she did not solve the problem by coding the text.

Student I was the third of three students who actually provided a thorough explanation as to what the question was asking. He also answered the question correctly and coded the text properly. For the second question, he coded the proper information and answered the question correctly, but only did so numerically. The skill he used in the first question (providing a thorough explanation) was not present for the answer in the second question.

The students who were absent from this instructed intervention were Student A, Student B, and Student H. Multiple attempts were made to have them complete the

assignment, but to no avail were they able to participate in the week's intervention

To assess students' skill of combining the strategy of text coding what was read with journaling about the context of the problem before solving, their progress for this intervention is reflected in the table below. The table showed how students fared overall in the activity whether they provided a written explanation or not.

Table 1.3
Combining Coding with Journal Writing
Strategy

<i>Question</i>	<i>#1</i>		<i>#2</i>	
	Coding	Journal Writing	Coding	Journal Writing
C	√	√	√	√
D	√	√	√	-
E	-	√	-	-
F	√	√	√	-
G	√	-	-	√
I	√	√	√	-
	83.00%	83.00%	66.00%	33.00%

Week Six

The sixth week of the study occurred from January 22, 2015 through January 29, 2015. During this week, students participated in lessons that would integrate math computation skills, coding read text, and writing down steps of the problem solving process. In a study conducted by Monroe and Wilcox (2011), research was presented that students who take notes *get to know* the math and have deeper connections with the content. Internalizing mathematics is a skill students need to possess that will help them draw deeper connections with the material in order to communicate learned information more independently (Monroe & Wilcox, 2011).

This first part of the lesson included one word problem in which students were asked to code the text, notate the steps they thought the problem required to solve the problem, and to work out the problem to the right of the steps they jotted down. This lesson was structured to help students take a deeper look at how they solve problems and to see if their *writing to learn* practices were working effectively (Borasi and Rose, 1989).

The word problem asked students to figure out the total number of items sold (hot dogs and soda) when given the cost of the items (\$.50 for soda and \$1.50 for hot dogs; \$78.50 total dollars profited) and the total combined items sold (87).

Student A did not attempt to code the text. Instead, he decided to go straight into writing down the steps required to solve the question. Though this was a great attempt to solve the question, his answer was not correct. Highlighting pertinent information is a method that could have exhibited his understanding of the question.

Student B properly coded the text that fit with each other so she did not confuse the organization of information. Her steps were clear and correct, as she was able to answer the question from start to finish.

Student C was able to code the text properly, but did not organize his thoughts clearly enough to create orderly steps for solving the question. His steps were mixed up and he did not attempt to solve the problem.

Student D was present for the activity, but did not participate. She was prompted multiple times to join in with the group but refused.

Student E did attempted to code the text, while his written steps to solving the problem were accurate. However, he did not work independently to solve the question;

he worked with Student G.

Student F arrived late to the intervention, but did code the text upon arriving to class. From there, he was able to start creating the steps to solve the question, but he was not able to finish. He exhibited an understanding of the context of the problem, but ran out of time to complete the problem.

Student G coded the text properly, underlining the pertinent information that was necessary for her to create steps in order to solve the question. Her steps were accurate and she solved the question correctly. She used some of her notes from her daily Algebra class, which allowed her to recognize the practice she was performing.

Student H did not code the text and struggled to create steps. After attempting to write one incomplete equation, he did not finish the question. Student I coded the text properly and attempted to create steps to solve the question. His written steps were mixed up which gave him an incorrect answer.

To assess students' skill of coding text, notating steps, and solving the problems, their progress for this intervention is reflected in the table below. The table showed how students fared overall in the activity.

Table 1.4
Combining Coding and Writing Steps

	Coding	Steps Written	Problem Solved
A	-	-	-
B	√	√	√
C	√	-	-
D	-	-	-
E	√	√	√
F	√	-	-
G	√	√	√
H	-	-	-
I	√	√	-
	66.00%	44.00%	33.00%

The second part of the lesson included two math computation problems that students were learning to solve in the general curriculum classroom (substitution and elimination method systems of equations). Students had to reflect back on their notes from class and journal about the process of the systems presented. The instructor guided them through the lesson by asking guided questions to assist them through the process: *how do we know which method to use, what do we do first when using this method, etc.* After journaling about the steps, students attempted to solve the system using one of the methods.

Student A did know which method to use for each question, but that is where he stopped. He did not attempt to solve any of the questions once he realized he was mixing the methods up. Student D solved the first question correctly by using the correct method, but she did not mention which one it was. She did not attempt to write down steps to solving this question as well. She did not attempt the second question.

Student E did list the correct method for the first question and attempted to write

the steps for solving the problem. However, his knowledge of the elimination and substitution was not evident in this activity, as he did not solve anything. Student F did list the correct method used to solve the first question. He also made an attempt to list the steps of solving the question. After correctly solving for one variable, he stopped. Full completion of question 1 was not evident, but his use of strategy was displayed.

Student G was the only student to finish question 1. Though she made minor mistakes (applying positive signs to negative numbers), she correctly listed the method used to solve the question, and wrote every proper step she performed to solve the question. Student I did not exhibit that he understood the activity. He did not complete the problem and wrote down a restatement of the researcher's guiding instructions.

The students who were absent from this instructed intervention were Student B, Student C, and Student H. Multiple attempts were made to have them complete the assignment, but to no avail were they able to participate in the week's intervention

To assess students' skill of journaling about the steps and using those steps to solve a system of equations, their progress for this intervention is reflected in the table below. The table showed how students fared overall in the activity when they provided a written explanation or not.

Table 1.5*Journaling and Use of Notes*

	<i>Question #1</i>		<i>Question #2</i>	
	Steps Written	Problem Solved	Steps Written	Problem Solved
A	-	-	-	-
D	-	√	-	-
E	√	-	-	-
F	√	√	-	-
G	√	√	-	-
I	-	-	-	-
	50.00%	50.00%	0.00%	0.00%

Week Seven – Week Eight: TOMA-2 Post-Test

The last two weeks of the study concluded with the researcher administering the TOMA-2 to the student participants for a second time. The assessment was administered to nine students again to observe the amount of growth the student participants incurred through weeks of direct intervention.

The following tables displayed how the students' post-test scores for the subtest areas of the TOMA-2 (vocabulary, computation, general information, story problems, and attitude toward math) measured versus their pre-test scores from December. The figure also charts how the students' math quotients measure up against each other.

Figure 1.7: TOMA Vocabulary Raw Score Pre-Test vs. Post-Test - February 2015

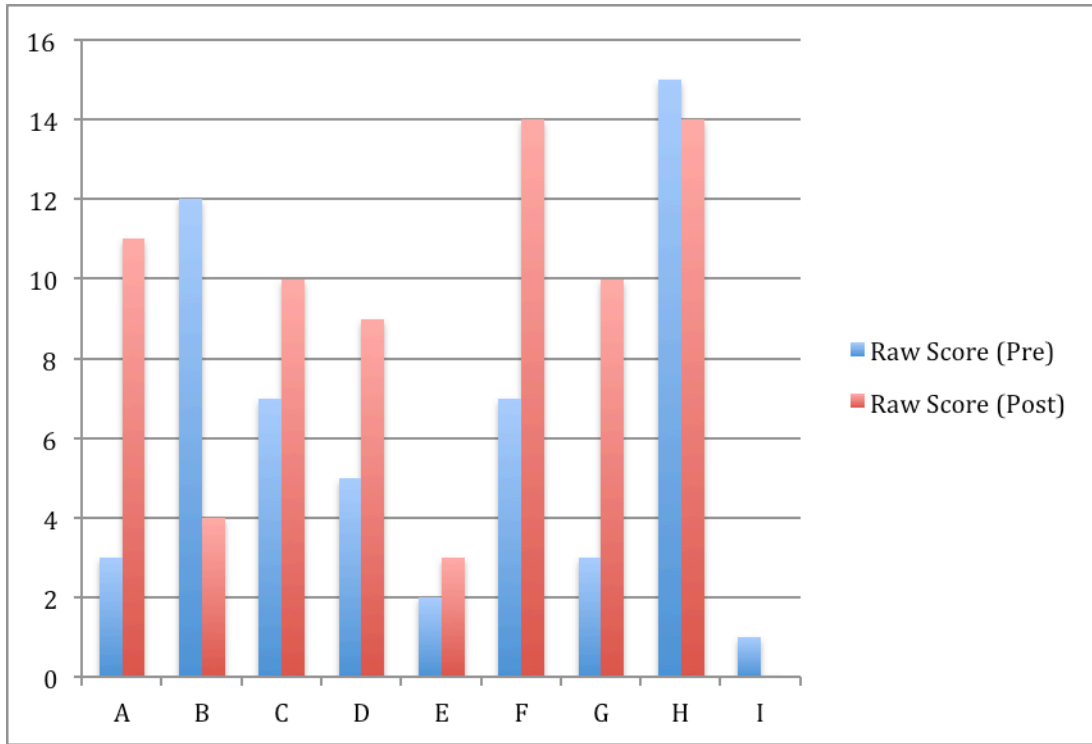


Figure 1.8: TOMA Computation Raw Score Pre-Test vs. Post-Test - February 2015

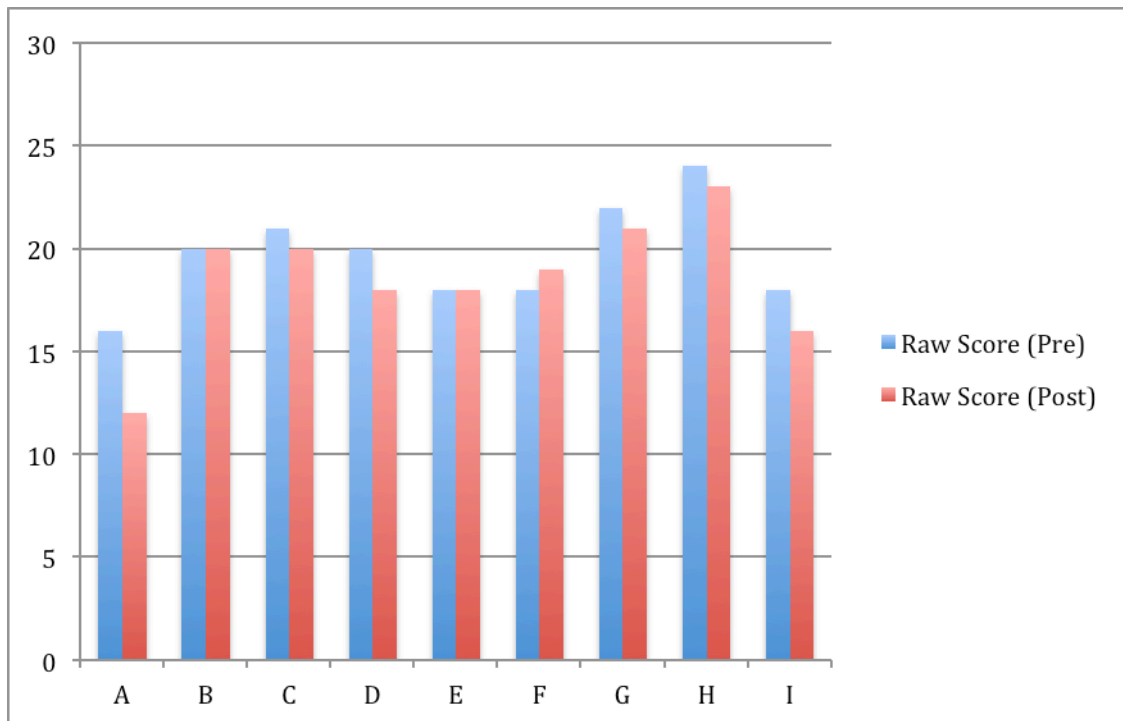


Figure 1.9: TOMA General Information Raw Score Pre-Test vs. Post-Test - February 2015

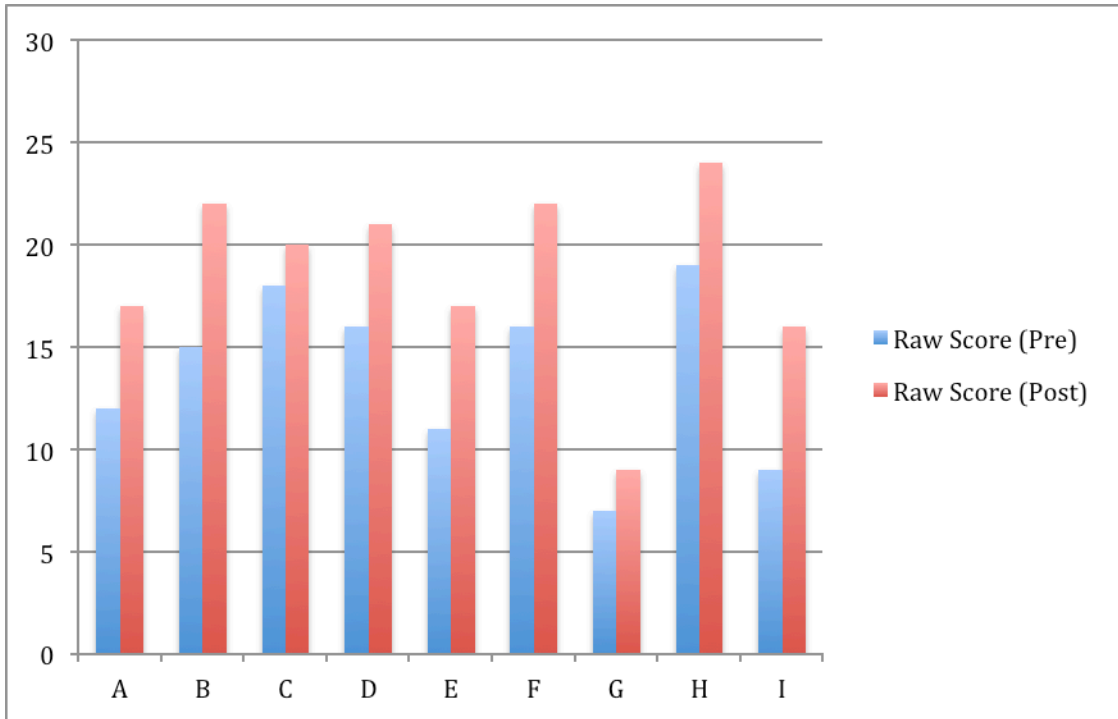


Figure 1.10: TOMA Story Problems Raw Score Pre-Test vs. Post-Test - February 2015

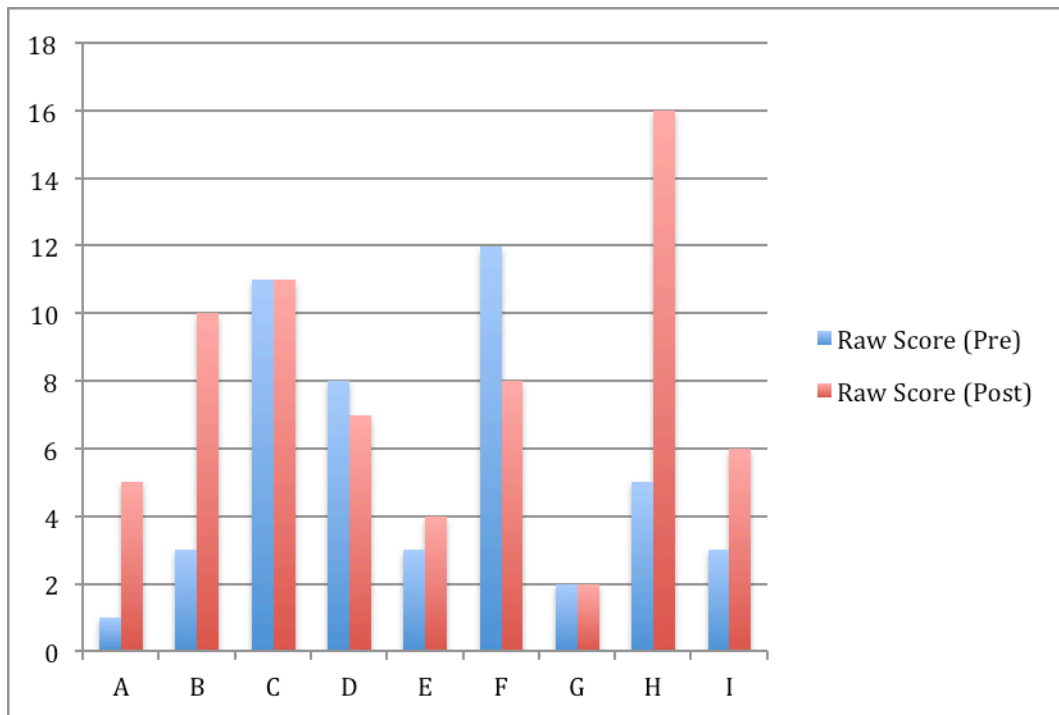


Figure 1.11: TOMA Attitude Toward Math Raw Score Pre-Test vs. Post-Test - February 2015

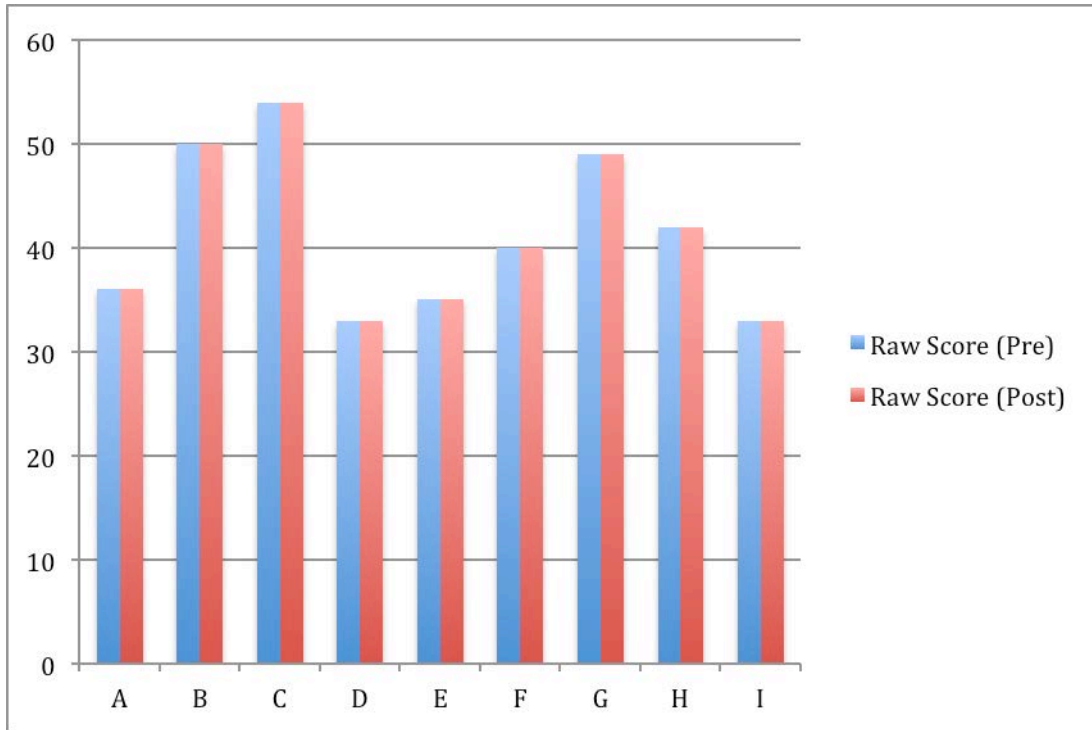
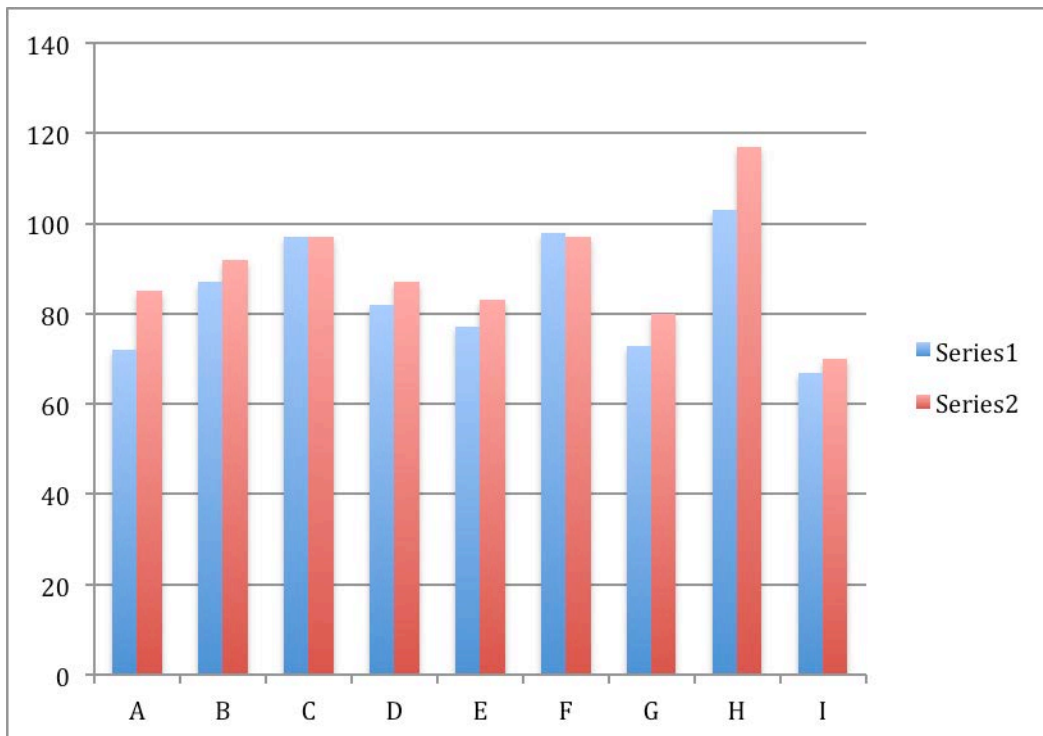


Figure 1.12: TOMA Math Quotient Raw Score Pre-Test vs. Post-Test - February 2015



Conclusion

The first section of this chapter presented the data that was collected from the assignment of the TOMA-2 as a pre-test in December. Each student's scores were discussed in detail. The second section of this chapter presented all of the data that was collected after the pre-test was assigned. Weekly interventions (from December through February) were scheduled for students to attend, where they received instruction of text coding, note taking, and how both relate to reading comprehension when solving problems in the mathematics classroom. The third section of this chapter presented the data that was collected from the assignment of the TOMA-2 as a post-test in February. The pre-test and post-test scores were displayed in tables to give a clear picture of improvements students made.

The next chapter details the connections of the results presented in this chapter to the research presented in Chapter 2. It explains the results as well as the strengths and limitations of the data. Finally, it presents recommendations for the nine students involved in this study to make any order to further their progress with reference to the Common Core State Standards (2015) and IDEA.

Chapter 5

Conclusions

This chapter connected the interventions designed for the research study with the reading comprehension strategies of text coding and journal writing. Literature presented in Chapter 2 supported the use of the two strategies in the mathematics classroom and confirmed that the instruction of such strategies would improve student reading comprehension in the mathematics classroom. The results of student growth from pre-test to post-test were then examined along with how the interventions aided growth in text coding and journal writing inside and outside of the general education classroom. The chapter then presented specific strengths and limitations of the research study, with time constraints being the most discussed negative impact on the data collection. Specific recommendations were suggested for each of the nine students involved in the study were given.

Connections to Existing Research

The research study was conducted to assess the improvement in reading comprehension of high school freshmen enrolled in a mathematics class. Students participated in interventions geared towards the use of text coding and journal writing to strengthen their reading comprehension skills. Each of the students who participated had their interventions designed by obtaining information found in their cumulative files, teacher observations, and research analyzed from numerous scholars.

Bosse and Faulconer (2008) researched that a student's knowledgeable skills in comprehending narrative text had a strong correlation to how well students could comprehend mathematical text; the researchers found it essential for teachers to instruct

students in the skill of coding vocabulary, which would help students develop a deeper understanding of the text (Bosse & Faulconer, 2008). Moreover, Hoover and Gough (1990) confirmed that the strategy of text coding was essential to help students organize their full understanding of creating meaning from text.

All students involved in the study participated in the text coding interventions during week three of the study. Of the nine students, five successfully text coded the given word problems (55%). However, one of the five students was not able to successfully answer all three questions given. Student E was the student who did not answer all three questions and was not able to demonstrate strength in coding the text. Reehm and Long (1996) equated such performance to students misinterpreting symbols in mathematics, and not having a developed vocabulary to identify and assign meaning to words. Through observation, Student E did not display an understanding of which mathematical terms or operations were pertinent to building an equation to solve the problem.

Six of the nine students involved in the research study participated in the first introductory lesson of journal writing that focused on combining the strategy of coding the text that was read with journaling about the context of the problem before solving. The lesson took place during week five of the study. Graham and Hebert (2010) researched that students are more successful in mathematics when they create text while reading as a way to better understand complex text. It was Carter and Dean (2006) who said teachers must present numerous opportunities to students to clarify and extend their knowledge of words and concepts in order to build on conceptual knowledge of mathematical terminology.

Of the six students, four successfully text coded the given word problems and provided written explanations for their answers (66%). Two of the six students were not able to successfully combine the comprehension strategies while solving the word problems: Student E and Student G. The two students made some improvements over the course of five weeks, but still displayed areas of deficiency.

Student E continued to struggle with coding the text, as a sign that vocabulary recognition was still troubling him. As for Student G, her vocabulary recognition skills were evident through her strong text coding skills. However, both students struggled to effectively communicate explanations of the steps they took to solve the problems. Carter and Dean (2006) shared that students must be able to read and comprehend word problems effectively to become better problem solvers. When this skill is achieved, students can better communicate through reading and writing mathematics.

During week six of the study, students participated in lessons that would integrate math computation skills, coding read text, and writing down steps of the problem solving process. The questions continued to help further their knowledge of vocabulary through text coding. The exercise also helped further student knowledge of vocabulary through text coding and journal writing. In a study conducted by Monroe and Wilcox (2011), research was presented that students who take notes *get to know* the math and have deeper connections with the content. The lesson was broken into two parts to help students make deeper connections with the material, which would help them communicate the mathematics more effectively.

Each of the nine students involved in the research study participated in the first lesson of week six. The lesson included one word problem in which students were asked

to code the text, notate the steps they thought the problem required to solve the problem, and to work out the problem to the right of the steps they jotted down. The lesson was structured to help students take a deeper look at how they solve problems and to see if *writing to learn* practices were working effectively (Borasi and Rose, 1989).

Of the nine students, four were successfully able to combine the strategies of text coding and notation of their steps for solving the problem (44%). However, one of the four students was not able to successfully answer the question correctly through the combination of text coding and note taking. Student I improved his text coding skill for the lesson, but was unable to record strong notes during class instruction and make additional notes to the note-taking process. This resulted in Student I's notation of steps to solve the problem being ineffective. He continued to confuse his selection of which mathematical operation was necessary for solving the given questions.

Six of the nine students involved in the research study participated in the second lesson of week six. The lesson included two math computation problems that students were learning to solve in the general curriculum classroom (substitution and elimination method systems of equations). Students had to reflect back on their notes from class and journal about the process of the systems presented. Adams and Lowery (2007) shared research about students who benefited from an activation of prior knowledge that exposed students to a language they see across contexts. This lesson aimed to push students to understand the significance of using note taking to aid their comprehension.

Of the six students, two made an attempt to solve the question by using their notes that were taken from a previous class (33%). Student F was able to communicate steps that he used to solve the problem by talking through them with the teacher, and writing

them down on the worksheet. Though he did not finish solving the entire problem, Student F displayed that he was aware of the mathematical concepts that took place. Student G, as noted in the previous chapter, was the only student to finish the problem. She exhibited the strongest communication of the note taking process; Student G identified each step correctly, used each mathematical operation properly, and solved for two variables. Though her signs were slightly mixed up, she showed the most strength in this lesson.

After reviewing the data collected through research and observations, it was evident that students benefited from the continual practice of using certain strategies inside and outside of the mathematics classroom. Adams and Lowery (2007) shared in their research that students need to actively read mathematics text in order to describe, explain, guide, instruct, and present process of “doing mathematics. When this is achieved, comprehension is evident when students are able to perform mathematical activities such as solving word problems, computing math equations, and communicating steps of the process.

The research study was designed to give students multiple opportunities to exhibit understanding of mathematical language. The two strategies the researcher guided students through were components of text coding (highlighting, circling, identifying vocabulary) and journaling as a means of note taking. Hoover and Gough (1990) believed that word recognition and understanding language were at the center of teacher instruction to implement reading strategies students could use in mathematics. While some students may have made gains in the research, others exhibited deficiencies that will continue to be addressed outside of the research study.

Explanation of Results

In this section, students' results from the pre-test assessment and the post-test assessment will be analyzed as a means of comparing growth to peers of students' age equivalent and grade equivalent. To conclude this section, student progress in the weekly interventions will be assessed as means of reviewing overall performance of the two-month research study.

Assessments

Student A exhibited growth in three of the four subtests of the TOMA-2; growth was assessed from a review of the pre-test and the post-test. The areas where he displayed growth in mathematical understanding were Vocabulary recognition, General Information, and answering Story Problems; he declined understanding in Computation. His Vocabulary raw score increased from a 3 to an 11, placing him at an Above Average level with his peers. His General Information raw score increased from a 12 to a 17, placing him at an Average level with his peers. His Story Problems raw score increased from a 1 to a 5, placing him at a Poor level with his peers.

His Math Quotient raw score, which takes into account the composite math ability of student's mathematical competency, also increased from a 72 to an 85, placing him at a Below Average level with his peers. Though he did improve his Math Quotient, it should be paid attention to that the overall score is below 90, which Brown, Cronin, and McEntire (1994) shared can give a bigger picture as to what areas students have impaired mathematical levels. With his decline in Computation (from a 16 to a 12 – lowest out of nine students), it was noted that Student A will need more direct one-on-one instruction with strengthening his skills in solving arithmetical problems.

Student B exhibited growth in two of the four subtests of the TOMA-2; growth was assessed from a review of the pre-test and the post-test. The areas where she displayed growth in mathematical understanding were General Information and answering Story Problems; she declined understanding in Vocabulary recognition. Her score for Computation stayed at 20 (Average level) – tied for the third highest out of nine students. Her General Information raw score increased from a 15 to a 22, placing her at an Average level with her peers. Her Story Problems raw score increased from a 3 to a 10, placing her at an Average level with her peers.

Her Math Quotient raw score, which takes into account the composite math ability of student's mathematical competency, also increased from an 87 to a 92, placing her at a Below Average level with her peers. She improved her Math Quotient enough to reach over 90, which Brown, Cronin, and McEntire (1994) shared can give a bigger picture as to what areas students have impaired mathematical levels. With her decline in Vocabulary recognition (from a 12 to a 4), it was noted that Student B will need more direct one-on-one instruction with strengthening her skills in understanding words used in mathematical thinking.

Student C exhibited growth in two of the four subtests of the TOMA-2; growth was assessed from a review of the pre-test and the post-test. The areas where he displayed growth in mathematical understanding were Vocabulary recognition and General Information; he declined understanding in Computation and answering Story Problems. His Vocabulary raw score increased from a 7 to a 10, placing him at an Average level with his peers. His General Information raw score increased from an 18 to a 20, placing him at an Average level with his peers.

His Math Quotient raw score, which takes into account the composite math ability of student's mathematical competency, decreased from a 98 to a 97, placing him at an Average level with his peers. Though his Math Quotient declined, it should be paid attention to that the overall score is still above 90, which Brown, Cronin, and McEntire (1994) shared can give a bigger picture as to what areas students have impaired mathematical levels. With his decline in Computation (from a 21 to a 20 – tied for third highest out of nine students) and answering Story Problems (from a 12 to an 11 – second highest out of nine students), it was noted that Student A could benefit from additional instruction with strengthening his skills in solving arithmetical problems, and reading and solving written word problems.

Student D exhibited growth in two of the four subtests of the TOMA-2; growth was assessed from a review of the pre-test and the post-test. The areas where she displayed growth in mathematical understanding were Vocabulary recognition and General Information; she declined understanding in Computation and answering Story Problems. Her Vocabulary raw score increased from a 5 to a 9, placing her at an Average level with her peers. Her General Information raw score increased from a 16 to a 21, placing her at an Average level with her peers.

Her Math Quotient raw score, which takes into account the composite math ability of student's mathematical competency, also increased from an 82 to an 87, placing her at a Below Average level with her peers. Though she did improve her Math Quotient, it should be paid attention to that the overall score is below 90, which Brown, Cronin, and McEntire (1994) shared can give a bigger picture as to what areas students have impaired mathematical levels. With her decline in Computation recognition (from a 20 to

an 18) and answering Story Problems (from an 8 to a 7), it was noted that Student D will need more direct one-on-one instruction with strengthening her skills in solving arithmetical problems and solving written word problems.

Student E exhibited growth in three of the four subtests of the TOMA-2; growth was assessed from a review of the pre-test and the post-test. The areas where he displayed growth in mathematical understanding were Vocabulary recognition, General Information, and answering Story Problems; his score for Computation stayed at 18. He did not decline on any of the subtests. His Vocabulary raw score increased from a 2 to a 3, placing him at an Average level with his peers. His General Information raw score increased from an 11 to a 17, placing him at an Average level with his peers. His Story Problems raw score increased from a 3 to a 4, placing him at a Poor level with his peers.

His Math Quotient raw score, which takes into account the composite math ability of student's mathematical competency, also increased from a 77 to an 83, placing him at a Below Average level with his peers. Though he did improve his Math Quotient, it should be paid attention to that the overall score is below 90, which Brown, Cronin, and McEntire (1994) shared can give a bigger picture as to what areas students have impaired mathematical levels. With his low overall marks and low Math Quotient, it was suggested that Student E will need more specialized instruction with strengthening his skills in understanding words used in mathematical thinking, solving arithmetical problems, acknowledging mathematics used in everyday situations, and solving written word problems.

Student F exhibited growth in three of the four subtests of the TOMA-2; growth was assessed from a review of the pre-test and the post-test. The areas where he

displayed growth in mathematical understanding were Vocabulary recognition, Computation, and General Information; he declined understanding in answering Story Problems. His Vocabulary raw score increased from a 7 to a 14, placing him at an Above Average level with his peers. His Computation raw score increased from an 18 to 19, placing him at an Average level with his peers. His General Information raw score increased from a 16 to a 22, placing him at an Average level with his peers.

His Math Quotient raw score, which takes into account the composite math ability of student's mathematical competency, decreased from a 98 to a 97, placing him at an Average level with his peers. Though his Math Quotient declined, it should be paid attention to that the overall score is still above 90, which Brown, Cronin, and McEntire (1994) shared can give a bigger picture as to what areas students have impaired mathematical levels. With his decline in Story Problems (from a 12 to an 8), it was noted that Student F could benefit from additional instruction with strengthening his skills in reading and solving written word problems.

Student G exhibited growth in two of the four subtests of the TOMA-2; growth was assessed from a review of the pre-test and the post-test. The areas where she displayed growth in mathematical understanding were Vocabulary recognition and General Information; her score for answering Story Problems stayed at 2. She declined in Computation. Her Vocabulary raw score increased from a 3 to a 10, placing her at an Average level with her peers. Her General Information raw score increased from a 7 to a 9, placing her at a Poor level with her peers.

Her Math Quotient raw score, which takes into account the composite math ability of student's mathematical competency, also increased from an 73 to an 80, placing

her at a Below Average level with her peers. Though she did improve her Math Quotient, it should be paid attention to that the overall score is below 90, which Brown, Cronin, and McEntire (1994) shared can give a bigger picture as to what areas students have impaired mathematical levels. With her low overall marks and low Math Quotient, it was suggested that Student G will need more specialized instruction with strengthening her skills in understanding words used in mathematical thinking, solving arithmetical problems, acknowledging mathematics used in everyday situations, and solving written word problems.

Student H exhibited growth in two of the four subtests of the TOMA-2; growth was assessed from a review of the pre-test and the post-test. The areas where he displayed growth in mathematical understanding were General Information and answering Story Problems; he declined understanding in Vocabulary recognition and Computation. His General Information raw score increased from a 19 to a 24, placing him at an Average level with his peers. His Story Problems raw score increased from a 5 to a 16, placing him at an Above Average level with his peers.

His Math Quotient raw score, which takes into account the composite math ability of student's mathematical competency, increased from a 103 to a 117, placing him at an Above Average level with his peers. His Math Quotient was the only one of the nine students to have reached over 100, which Brown, Cronin, and McEntire (1994) shared that the student possesses a considerable amount of knowledge in integrated mathematical concepts. However, he did decline in Vocabulary recognition (from a 15 to a 14 – tied for highest out of nine students) and Computation (from a 24 to a 23 – highest out of nine students). Student H will continue to be monitored on how he uses his skills

to solve arithmetical problems.

Student I exhibited growth in two of the four subtests of the TOMA-2; growth was assessed from a review of the pre-test and the post-test. The areas where he displayed growth in mathematical understanding were General Information and answering Story Problems; he declined understanding in Vocabulary recognition and Computation. His General Information raw score increased from a 9 to a 16, placing him at a Below Average level with his peers. His Story Problems raw score increased from a 3 to a 6, placing him at a Poor level with his peers.

His Math Quotient raw score, which takes into account the composite math ability of student's mathematical competency, also increased from an 67 to a 70, placing him at a Poor level with his peers. Though he did improve his Math Quotient, it should be paid attention to that the overall score is below 90, which Brown, Cronin, and McEntire (1994) shared can give a bigger picture as to what areas students have impaired mathematical levels.

With his overall low scores and decline in Vocabulary recognition (from a 1 to a 0 – the lowest of the nine students) and Computation (from an 18 to a 16 – second lowest out of nine students), it was noted that Student I will need more specialized direct one-on-one instruction with strengthening his skills in understanding words used in mathematical thinking, solving arithmetical problems, acknowledging mathematics used in everyday situations, and solving written word problems.

Interventions

The research study conducted over the course of December 2014 through February 2015 was designed to be a two-month intervention for students who were

having their reading comprehension skills in the classroom assessed. The design of the interventions was linked to the administration of the pre-test TOMA-2 and the administration of the post-test TOMA-2. Interventions took place between the administrations of the two tests in order to assess if the sessions would help students develop deeper comprehension skills in the mathematics classroom.

Week Three introduced students to the concept of text coding use in the mathematics classroom. The concept students worked on was reading through word problems and picking pertinent information that was necessary to identify for solving the problem. The skills students practiced were highlighting, underlining, and tagging key information in a word problem. From there, students worked to solve guiding questions that were asked of them. This intervention was designed to improve student scores in the TOMA-2 subtests of Vocabulary, General Information, and Story Problems.

Week Four introduced students to the concept of interpreting information from graphs; students continued to build upon the practice of text coding strategy that was introduced in Week Three. Students were given questions to answer, where they were asked to rely on the information given in the graphs. This intervention was designed to improve student scores in the TOMA-2 subtests of Vocabulary and Story Problems.

Week Five introduced a combination of text coding and student journal writing. The concept students worked on was to communicate the process of solving a word problem not only through numbers, but using spoken and written words. The intervention was designed to build student confidence in communicating process of problem solving. The intervention was also designed to improve student scores in the TOMA-2 subtests of Vocabulary, Computation, General Information, and Story

Problems.

Week Six introduced a computation problem and combining that with journal writing. The concept students worked on was to identify and communicate the process of solving for missing values, and using those steps to solve the problem. The intervention was designed to build student confidence in communicating process of problem solving. The intervention was also designed to improve student scores in the TOMA-2 subtests of Vocabulary and Computation.

Student A participated in the intervention activities during Week Three, Week Four, and Week Six; he was not present during the intervention activity introducing journal writing with text coding during Week Five. The results from Week Three show that Student A only completed one of four tasks properly (25%). However, he completed the entire intervention activity accurately during Week Four (100%). During Week Six, he did not accurately use the combination of text coding and journal writing to solve the questions (0% completion). The results of his TOMA-2 post-test show that Student A increased his scores in three of the four assigned subtests (75%) from the pre-test (Vocabulary, General Information, and Story Problems).

Student B participated in the intervention activities during Week Three, Week Four, and Week Six; she was not present during the intervention activity introducing journal writing with text coding during Week Five. The results from Week Three show that Student B only completed all of the tasks properly (100%). She also completed the entire intervention activity accurately during Week Four (100%). During Week Six, she completed four out of five tasks accurately through the combination of text coding and journal writing to solve the questions (80%). The results of her TOMA-2 post-test show

that Student B increased her scores in two of the four assigned subtests (50%) from the pre-test (General Information and Story Problems).

Student C participated in the intervention activities during Week Three, Week Four, Week Five, and the first half of Week Six. The results from Week Three show that Student C completed all four tasks properly (100%). However, he only completed two out of four tasks accurately during Week Four (50%). During Week Five, Student C combined the strategies of journal writing and text coding accurately (100%). As for Week Six, he did not accurately combine note taking with text coding and did not complete the tasks (0% completion). The results of his TOMA-2 post-test show that Student C increased his scores in two of the four assigned subtests (50%) from the pre-test (Vocabulary and General Information).

Student D participated in the intervention activities during Week Three, Week Five, and Week Six; she was not present during the intervention activity combining graph interpretation with text coding during Week Four. The results from Week Three show that Student D only completed one of four tasks properly (25%). However, she completed the three out of four tasks accurately during Week Five (75%). During Week Six, she did not accurately use the combination of text coding and journal writing to solve the questions (20% completion). The results of her TOMA-2 post-test show that Student D increased her scores in two of the four assigned subtests (50%) from the pre-test (Vocabulary and General Information).

Student E participated in the intervention activities during Week Three, Week Four, Week Five, and Week Six. The results from Week Three show that Student E only completed two of four tasks properly (50%). He completed the two out of four tasks

accurately during Week Four (50%). During Week Five, he did not accurately use the combination of text coding and journal writing to solve the questions (25% completion). The results for the intervention in Week Six displayed that Student E improved his task completion by combining note taking and text coding (80% completion). The results of his TOMA-2 post-test show that Student E increased his scores in three of the four assigned subtests (75%) from the pre-test (Vocabulary, General Information, and Story Problems).

Student F participated in the intervention activities during Week Three, Week Five, and Week Six; he was not present during the intervention activity combining graph interpretation with text coding during Week Four. The results from Week Three show that Student F completed all four tasks properly (100%). He accurately completed three out of four tasks combining journal writing with text coding during Week Five (75%). As for Week Six, he accurately combined note taking with text coding and completed three out of five tasks (60% completion). The results of his TOMA-2 post-test show that Student F increased his scores in three of the four assigned subtests (75%) from the pre-test (Vocabulary, Computation, and General Information).

Student G participated in the intervention activities during Week Three, Week Four, Week Five, and Week Six. The results from Week Three show that Student G completed all four tasks properly (100%). She accurately completed three out of four tasks combining graph interpretation with text coding during Week Four (75%). In Week Five, she was able to combine journal writing and text coding strategies accurately two out of four times (50%). As for Week Six, she accurately combined note taking with text coding and completed five out of five tasks (100% completion). The results of her

TOMA-2 post-test show that Student G increased her scores in two of the four assigned subtests (50%) from the pre-test (Vocabulary and General Information).

Student H participated in the intervention activities during Week Three and the first half of Week Six; he was present for the graph interpretation lesson during Week Four, and the combination of journal writing and text coding lesson during Week Five. The results from Week Three show that Student H struggled to complete any of the tasks properly (0%). As for Week Six, he also did not complete any of the tasks that were asked of him (0%). The results of his TOMA-2 post-test show that Student H increased his scores in two of the four assigned subtests (50%) from the pre-test (General Information and Story Problems).

Student I participated in the intervention activities during Week Three, Week Four, Week Five, and Week Six. The results from Week Three show that Student I only completed one of four tasks properly (25%). However, he accurately combined the skills of graph interpretation and text coding by completing three out of four tasks accurately during Week Four (75%). During Week Five, Student I completed three out of four tasks (75%). During Week Six, he accurately combined note taking and text coding two out of five times (40% completion). The results of his TOMA-2 post-test show that Student I increased his scores in two of the four assigned subtests (50%) from the pre-test (General Information and Story Problems).

Strengths and Limitations

The research study attempted to introduce reading comprehension strategies that not only could meet the needs of the students in a smaller setting where they received more personalized instruction from their service provider (4 students in one section and 5 students in the other section), but also in the general education classroom with 40-plus students in the classroom. The specialized sessions were designed to help improve the methods of how they communicate mathematically whether it was verbal or written. Students involved in the study worked hard to implement the practiced comprehension skills in their Algebra classroom, however varied results were produced from all of the students involved. These varied results were reflective of limitations that affected the outcomes of the study.

One of the constraints on the research study was the factor that time played in the collection of data. The first time limitation was the fact that the testing was administered over a two-week period. With the school setting being in its first year of high school, general education teachers were less likely to allow students to miss class time to complete an assessment that did not deal with their classroom material. This time constraint affected the data collection at the start of the study in December; students received interventions two weeks apart due to the holiday break in December and January.

The second constraint that played a key factor in the data collection was that students were not seen in one group of nine because they were receiving two different interventions (reading comprehension for mathematics and English Language Arts reading comprehension). The students were grouped into two different groups and

received services from two different service providers every other day. Students never received consistent day-to-day instruction, as there was always a break in intervention.

The third constraint that was a factor in the collection of data was the 25-minute intervention period that was allotted towards the end of November for students to receive direct interventions from service providers. The 25-minute period was not originally scheduled on the school calendar and was negotiated to become a standing period for the duration of the school year with the school administration. Even with the intervention period taking place, it was still hampered by distractions such as student attendance, late arrivals, before end of school announcements, and school enrichment clubs happening during the same period. The fact that the period took place 25-minutes before school was dismissed was a challenge as well, as students sometimes exhibited disinterested demeanor towards mathematics intervention.

Although challenges were posed with the collection of data during the research study, student growth was still achieved throughout the duration of the program. Students were observed integrating the learned comprehension strategy of text coding not only in their Algebra class, but in classes such as Physics and AP Human Geography. Students are carrying highlighters with them from class to class and using them to pick the pertinent information out in text that is read. In Algebra, students have improved their verbal communication of mathematical process while continuing to work on the written component. Students are answering various mathematical questions (systems of equations, word problems, etc.) using a step-by-step process in their notebooks that helps them process the math more effectively.

Each of the nine students involved in the study achieved a varied level of success

in the administered assessments, yet growth was evident by the increased raw scores from the TOMA-2 pre-test to the TOMA-2 post-test. Students also have begun to collaborate more frequently and effectively in a peer-to-peer group setting when placed in smaller groups during differentiated learning. Learning from each other has improved throughout the school year, as students have built up the self-confidence to communicate with the mathematical language in the classroom.

Recommendations for Students

The focus of the interventions in the research study was to observe the progress students made using the reading comprehension strategies of text coding and journal writing. The interventions were designed to have students practice using reading comprehension strategies that aligned with the Common Core State Standards (CCSS) of mathematics instruction. The mathematics intervention that students received aligned with the CCSS of high school Algebra. The first CCSS was “Seeing Structure in Expression (A-SSE)” (2015). The second CCSS was “Creating Equations (A-CED)” (2015). The third CCSS was “Reasoning with Equations and Inequalities (A-REI)” (2015).

Student A’s TOMA-2 scores indicated that he increased his raw scores in the areas of Vocabulary, General Information, and Story Problems. Student A participated in the majority of text coding activities (75%) that appeared to give him an advantage of receiving instruction that helped increase his raw scores for Vocabulary and General Information. His high level participation in the interventions indicated he was strengthening his skills of word recognition across contents, and applying literacy to mathematics. The applied skill aligned with the first CCSS of the study, “(A-SSE)”

(2015). However, it is recommended that he continue to receive support in the area of journal writing and note taking for his mathematics courses in the future.

His participation in the journal writing interventions was limited (33%). He continued to have challenges recording reflective thoughts and notes while following along with instruction. He is a student that will continue to be provided guided notes from his service provider. Though his Story Problems raw score increased, the increase was not significant enough to indicate if the intervention he received helped increase his score.

Student B's TOMA-2 scores indicated that she increased her raw scores in the areas of General Information and Story Problems. Student B participated in the majority of text coding activities (75%) that appeared to give her an advantage of receiving instruction that helped increase her raw scores for General Information. However, she did not increase her scores in Vocabulary. It is recommended that she continue to receive mathematics instruction in a print-environment where she can be exposed to vocabulary used across contents.

She participated in the journal writing activities more than half of the time (66%). The interventions she received appeared to support her improvement in building equations out of word problems that was evidenced by the increase of her raw score in the Story Problems subtest. The applied skill aligned with the second CCSS of the study, "(A-CED)" (2015).

Student C's TOMA-2 scores indicated that he increased his raw scores in the areas of Vocabulary and General Information. Student C participated in all of the text coding activities (100%) that appeared to aid him in the increases of his raw scores. However,

his Computation raw score slightly decreased. It is recommended that he participate in continual practice of arithmetic problems that will build into more complex algebraic and geometric mathematical questions. The continued intervention would be aligned to the third CCSS of the study, “(A-REI)” (2015).

Student D’s TOMA-2 scores indicated that she increased her raw scores in the areas of Vocabulary and General Information. Student D participated in the majority of text coding activities (75%) which appeared to give her an advantage of receiving instruction that helped increase her raw scores for Vocabulary and General Information. Her participation in the interventions indicated she was strengthening her skills of word recognition across contents, and applying literacy to mathematics. The applied skill aligned with the first CCSS of the study, “(A-SSE)” (2015).

However, it is recommended that she continue to receive support in the area of journal writing and note taking for her mathematics courses in the future. Though she participated all journal-writing activities (100%), her Story Problems raw score decreased. It is recommended that Student D continue to receive guided notes from her service provider to aid in the note taking process for all of her classes, in particular mathematics. The suggested route to take is to align her continued intervention with the first and second CCSS in the study (2015).

Student E’s TOMA-2 scores indicated that he increased her raw scores in the areas of Vocabulary, General Information, and Story Problems. Student E participated in all text coding activities (100%), which indicated he had an advantage from receiving direct instruction before the post-test. However, his scores averaged out as the third lowest of the nine student participants. It is strongly recommended that Student E enroll

in an outside of school supplemental program that provides additional instruction not only in reading comprehension in mathematics, but across all content. Through observations, it was evident that he would benefit from more direct one-on-one assistance from a service provider.

Student F's TOMA-2 scores indicated that he increased his raw scores in the areas of Vocabulary, Computation, and General Information. Student F participated in the majority of text coding activities (75%) that appeared to give him an advantage of receiving instruction that helped increase his raw scores for Vocabulary and General Information. His participation in the interventions indicated he was strengthening his skills of word recognition across contents, applying literacy to mathematics, and solving equations with missing variables. The applied skills aligned with the first CCSS of the study, "(A-SSE)" (2015), and the third CCSS of the study, "(A-REI)" (2015).

However, it is recommended that he continue to receive support in the area of journal writing; he did exhibit strength in note taking throughout the study. The increased intervention in journal writing will focus on improving Student F's reflective process about how he communicates the mathematical language. Throughout the study, he did not display confidence when prompted to speak or write about the mathematical concepts that were introduced. And though he participated in all journal-writing activities (100%), his Story Problems raw score decreased. The suggested route to take is to align his continued intervention with the first and second CCSS in the study (2015).

Student G's TOMA-2 scores indicated that she increased her raw scores in the areas of Vocabulary and General Information. Student G participated in all text coding activities (100%) that indicated she had an advantage of receiving instruction that helped

increase her raw scores for Vocabulary and General Information. Her scores averaged out as the second lowest of the nine student participants. It was strongly recommended that Student G enroll in an outside of school supplemental program that provides additional instruction not only in reading comprehension in mathematics, but across all content. Through observations, it was evident that she would benefit from more direct one-on-one assistance from a service provider.

Student H's TOMA-2 scores indicated that he increased her raw scores in the areas of General Information and Story Problems. Student H participated in half of text coding activities (50%) during the research study. The interventions appeared to give him an advantage of receiving additional instruction that helped increase his raw scores for Story Problems. He earned the highest increase in score for this subtest, and the highest earned score. The applied skill of highlighting and picking pertinent information out of word problems and building equations out of words was aligned with the first CCSS "(A-SSE)" (2015), and the second CCSS "(A-CED)" (2015).

Though Student H achieved the highest scores on the TOMA-2 overall, he still exhibited deficiencies throughout the duration of the study. He sometimes did not complete assignments, lacked confidence when communicating mathematical language, and did not fully participate in the journal writing activities, yet he was present for half of the sessions. It was documented that he becomes anxious when asked to write for he is not confident in his writing abilities. It was recommended that he be provided with guided notes from his service providers to alleviate additional anxiety during instruction time, where he can follow along with teachers more effectively. It is also recommended that the use of assistive technology, such as an Alpha Smart keyboard or a LiveScribe

Smartpen, be looked into to help with note taking during lectures.

Student I's TOMA-2 scores indicated that he increased his raw scores in the areas of General Information and Story Problems. Student I participated in all text coding activities (100%) that indicated he had an advantage of receiving direct instruction that helped increase his raw scores for General Information and Story Problems. However, he did not earn one point for the Vocabulary subtest on the administered post-test. His scores averaged out as the lowest of the nine student participants.

It is strongly recommended that he and his family meet with the service provider, teachers, and the administration about his academic progress during his first year of high school. During the prior school year, Student I was enrolled in a most restricted placement (MRP) classroom, where he did not receive the complex level of mathematics that would help prepare him for the Algebra he currently is enrolled in. Concern was shared that the academic rigor of the school was frustrating Student I, but everyone agreed the school environment was beneficial for his development. It was strongly recommended that he enroll in an outside of school supplemental program that provides additional instruction not only in reading comprehension in mathematics, but across all content. Through observations, it was evident that he would benefit from more direct one-on-one assistance from a service provider.

The reading comprehension strategies modeled in the intervention sessions were practiced in the general education classroom throughout the duration of the study. All nine students involved in the study were identified as students who qualified to receive special education services for academic support. All students met the criteria for receiving services identified under the Individuals with Disabilities Education Act

(IDEA). Under IDEA, students were entitled to a Free and Appropriate Public Education (FAPE) in their least restrictive environment (LRE). Legally, each student is entitled access to the general education curriculum; the students' LRE is their participation in the general education classroom. Each student met the criteria for special education under a primary label that was specific to their needs. Joint efforts between the students' service provider and families were essential for the continued intervention at home and school.

Conclusion

This chapter explained how the reading comprehension strategies of text coding and journal writing were used in the research study and how each student involved in the study benefited from strategies mentioned. Literature presented in Chapter 2 supported the instruction of the two strategies in the mathematics classroom and results of the research study confirmed that the implementation of such strategies improved student mathematical understanding. Every student involved in the study improved their overall Math Quotient thus confirming the validity of explicitly teaching and practicing the aforementioned reading comprehension strategies.

The results of the research study demonstrated how essential reading is in the mathematics classroom. The chapter then presented specific strengths and limitations of the research study, with time constraints being the most discussed negative impact on the data collection. Yet even with limitations, each student involved in the study achieved growth. Finally, this chapter offered specific recommendations for each of the nine students involved in the study. Differentiated recommendations were suggested to promote the continued growth of student achievement in the mathematics classroom. In conclusion, teaching reading comprehension in a mathematics classroom is beneficial to developing the mathematical understanding of students enrolled in special education.

Appendix A: Interest Survey

Answer the questions to the best of your ability:

1. I like to read short stories:

Circle YES or NO

2. I find reading for comprehension challenging:

Circle YES or NO

3. I find it is necessary to read for a mathematics class:

Not At All Somewhat Likely Neutral Likely Most
Definitely

Rank the difficulty of the next questions from 1 being the Least Difficult to 10 being the Most Difficult – Circle your answer choice:

4. Reading a word problem and knowing which important information to use in setting up a problem:

1 2 3 4 5 6 7 8 9 10

5. Solving a word problem with multiple steps that uses more than one mathematical operation

1 2 3 4 5 6 7 8 9 10

6. Constructing a graph based on the interpretation of given information in:

1 2 3 4 5 6 7 8 9 10

Demographic:

Circle that to which applies to you:

- You are a: MALE FEMALE

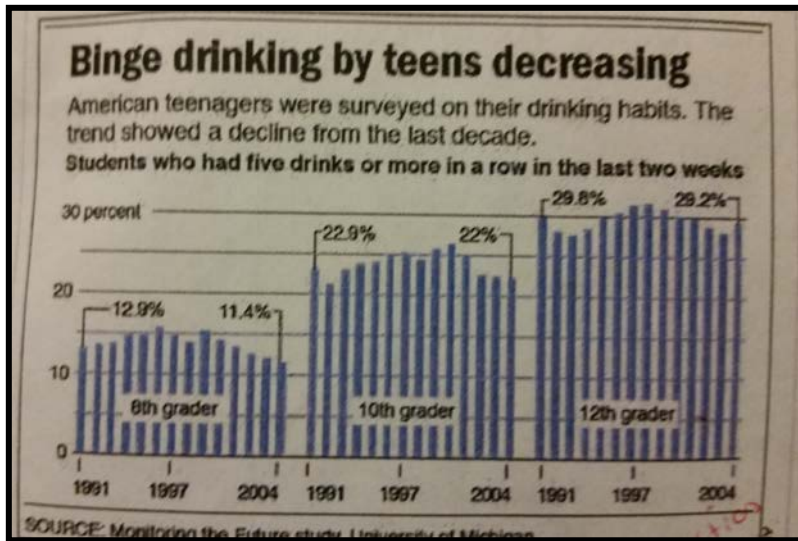
Appendix B: Intervention Worksheets**Week Three:**

Christmas is approaching and I am in need of completing some SERIOUS online shopping. I am shopping for three best friends and they have very different styles. I only want to spend \$200 total between their gifts. Currently I have gifts for two friends already: friend 1's gift costs \$75 and friend 2's gift costs \$66. Both gifts are taxed 8% under the Illinois State Tax. How much will I have left to spend on friend #3 after the other two gifts are purchased?

1. *What is this word problem asking me to do?*

2. *What mathematical operations am I using in this problem?*

3. *Do you know how to set this problem up to be solved? If so, how?*

Week Four:**Mathematics Focus Questions
Health**

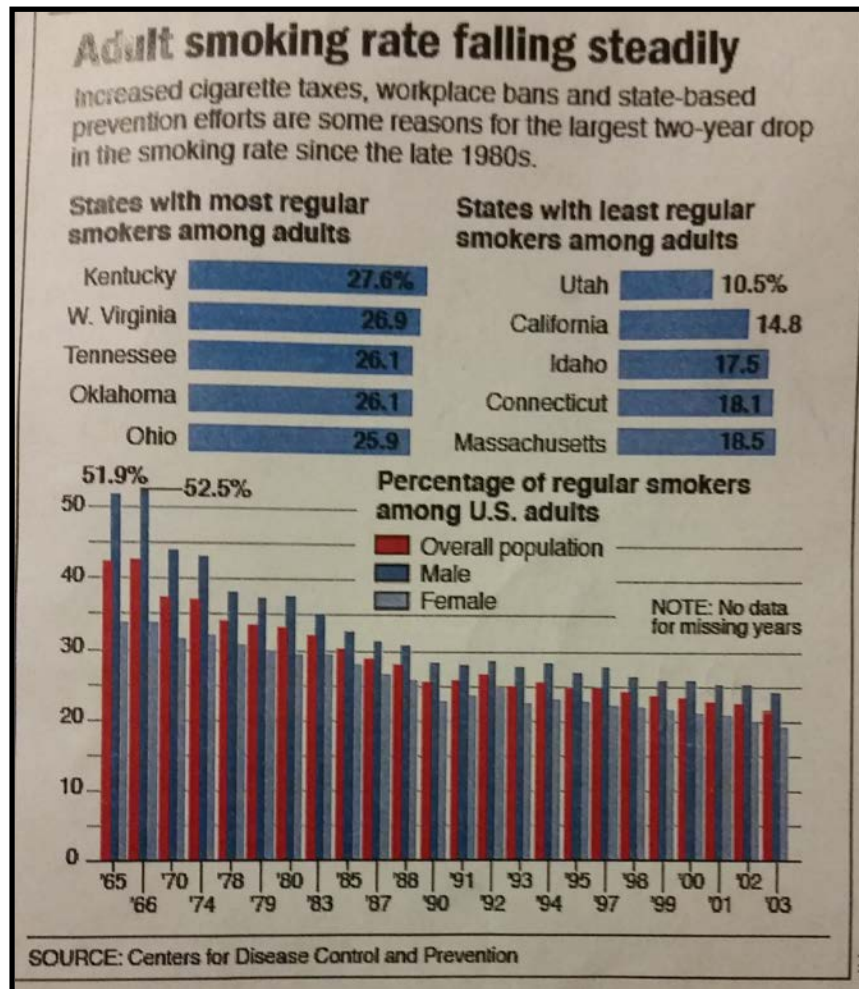
The chart on the left displays the results from surveys given over a 13-year period.

Students were anonymously surveyed regarding their drinking habits and the frequency of having five or more drinks in a row.

The study was conducted at the University of Michigan in Ann Arbor.

- A) What was the percent decrease of binge drinkers for 8th graders over the years 1991-2004?
- B) 354 students participated in the study of 12th graders in 2004. How many of those students were considered binge drinkers?
- C) In the 2008 study of 12th graders, 94 out of 327 were considered binge drinkers by the study. What percent did that represent?

Health Investigation #2



Write two complete sentences that summarize the information conveyed in the graph.

Why would the states of Kentucky, West Virginia, Tennessee, and Oklahoma lead the nation in adult smokers?

The graph conveys information relevant up to 2003. What would these statistics look like if the graph was to convey information current to 2013?

Week Five:

A deck of cards has 52 cards. There are four suits (spades, clubs, diamonds, and hearts). Two suits are red and two are black. If a card is picked at random, what is the probability that the card is a diamond?

About $\frac{1}{20}$ of a person's weight is blood.

About $\frac{2}{3}$ of the body's content is water.

Ashley weighs 100 pounds. About how much does her blood weigh?

Week Six:

You are running a concession stand at a basketball game. You are selling hot dogs and sodas. Each hot dog costs \$1.50 and each soda costs \$0.50. At the end of the night you made a total of \$78.50. You sold a total of 87 hot dogs and sodas combined. You must report the number of hot dogs sold and the number of sodas sold. How many hot dogs were sold and how many sodas were sold?

Steps:

1

2

3

4

Work out the problem:

In the space to the right, explain how
you would solve these system of equations.

Then solve:

Which method do you use to solve this: _____

$$\mathbf{x + 3y = 15}$$

$$\mathbf{2x + 1y = 15}$$

Which method do you use to solve this this: _____

$$\mathbf{x = 3y - 10}$$

$$\mathbf{3x + 5y = 12}$$

References

- Adams, T.L., & Lowery, R.M. (2007). An analysis of children's strategies for reading mathematics. *Reading and writing quarterly: Overcoming learning difficulties*; pp. 161-177.
- Bach, T., Bardsley, M.E. , Brown, K.G., & Kester Phillips, D.C. (2009). "But I teach math!" The journey of middle school mathematics teachers and literacy coaches learning to integrate literacy strategies into the math instruction. *Education*. Vol. 129, Issue 3, 467-472.
- Blagdanic, C., & Chinnappan, M. (2013). Supporting students to make judgements using real-life data. *Australian mathematics teacher*, 69(2), 4-12.
- Borasi, R., & Rose, B.J. (1989). Journal writing and mathematics instruction. *educational studies in mathematics*. Vol. 20, No. 4, 347-365.
- Bosse, M.J., & Faulconer, J. (2008). *Learning and assessing mathematics through reading and writing*. School science and mathematics, volume 108 (1), p.8-19.
- Brown, V., Cronin, M., & McEntire, E. (1994). *Test of mathematical abilities-2*. Austin, TX: Pro-Ed.
- Brown, V., Hammill, D.D., & Wiederholt, J.L. (1995). *Test of reading comprehension-3*. Austin, TX: Pro-Ed.
- Chappell, M.F., & Thompson, D.R. (2007). Communication and representation as elements in mathematical literacy. *Reading & writing quarterly: overcoming learning difficulties*; pp. 179-196.
- Corte, E.D., Masui, C, & Verschaffel, L. (2004). The CLIA-model: A framework for designing powerful learning environments for thinking and problem solving.

European journal of psychology of education. Vol. 19 Issue 4; pp. 365-384.

Fuentes, P. (1998). *Reading comprehension in mathematics*. Clearing house, volume 72 (2), p.81-88.

Graham, S., & Hebert, M. (2010). *Writing to read: Evidence for how writing can improve reading*. Retrieved from Carnegie Corporation of New York website: http://carnegie.org/fileadmin/media/publications/writingtoread_01.pdf

Monroe, E.E., & Wilcox, B. (2011). *Integrating writing and mathematics*. The reading teacher, volume 64 (7), p.521-529.