Master Capstone Project

Reading Comprehension in Math Instructions

A Classroom Action Research Study

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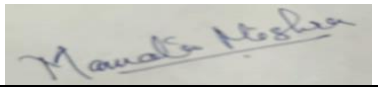
Submitted by		02-19-2024
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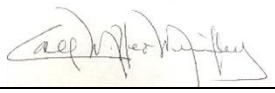
Approved by		02.23.2024
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Abstract

This was an action research project that took place in a first-grade general education classroom with 18 students participating in the study. It investigated the effectiveness of integrating reading comprehension strategies and solving math word problems. During the study students were pre-assessed for solving math word problems. Interventions were made by integrating *retelling* and *visualization* strategies for comprehending math word problems. The research indicated that there is an association between reading comprehension and solving math word problems. Practicing reading comprehension strategies as a tool and integrating them with math word problems displayed improvement in students' confidence and attempts to solve the word problems using correct mathematical operations.

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Introduction

"Math is hard, math is tough, I can't do it!!" This is the common feedback we hear in class as the students' progress in their grades. Why are students scared of math? Is it the inability to solve problems or just the anxiety? What part of math is challenging? Is it computation or word problems? The answer is usually word or story problems, and this is for many reasons.

Word problems in mathematics are the application of the learned concepts. Students decode the words of the mathematical language posed based on real-life scenarios, use the learned mathematical concepts to solve problems, and present their findings as a solution. As per Verschaffel et al. (2000), word problems are different from other mathematical tasks that are represented in the form of numbers or by mathematical notations since it is a multi-step task and the problem is mentioned in words which requires to be understood and solved accordingly using correct mathematical operations.

Comprehension is a part of the reading component that students use to decode their reading and display their understanding. There is evidence in the literature that many young children have difficulty at the stage of comprehending sentences. Vilnius-Tuohimaa et al. (2008) studied 225 children from fourth-grade aged nine to ten, for text comprehension and math word problem-solving performance tests. They found a strong interrelationship between literacy skills and math word problem-solving skills.

Problem Statement

"Math is boring; I don't understand it when it has words, I am not a math person, I can solve it when numbers and operations are mentioned; but I don't understand what to do when word problems are given." These are general statements I heard when I talked to students in the classroom. When I heard these statements from my fourth-grade daughter every day, these

thoughts were even more relevant to me. According to her, there are too many words to read and understand. “I get scared; I can’t do it!” I have consistently been trying to understand the cause of the issue and a specific focus area that I can implement and that will impact the students' learning process. I wondered if there is a relationship between differentiated instruction strategies in reading and math problem-solving. Can it be an integral part of the teaching-learning process, and does it affect students' achievement?

I observed various levels of students in a math classroom setup. Students were good at computing when the numbers and operations were provided; however, they struggled with story problems or word problems when the mathematical operations to be done were not mentioned directly.

Questions

I wondered how differentiated instructional strategies might affect student performance when solving math word problems. What are the fundamental issues affecting the students' ability to solve word problems? Are math story problem-solving abilities influenced by reading comprehension? Does allowing students to use a reading comprehension strategy help solve the issue of difficulty in math word problems?

- What makes decoding math word problems tough?
- What is the relationship between mastering reading components and math word problems?
- What strategies can be used to bridge the gap between understanding the word problems and applying computation skills?
- How can I help students fall in love with math?

Rationale

The first-grade class where I conducted my student teaching has prioritized standards for math and English Language Arts (ELA). One of the Common Core State Standards (CCSS) for ELA including RL.1.2 is to retell stories, including key details, and demonstrate understanding of their central message or lesson, Schools (2012). One of the math standards, 2. 1. OA.A.2, is to solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, by using objects, drawings, and equations with a symbol for the unknown number to represent the problem, Schools (2012). While most of the students in the class love to read for fun and do math computations, which is visible when they write math equations for the date every morning in different ways, they still struggle to make the connection between reading comprehension and math word problems. The study monitored the implementation of comprehension strategies to solve the math word problems.

Literature Review

This review focused on the relationship between reading components and math word problems and how students can develop strategies to excel in reading as well as in solving math word problems. Since math word problems require a significant ability to plan out the problem-solving process and organize the pieces of information effectively, apply the strategies to decode the mathematical language, relate their knowledge of computation skills, and enjoy the process of learning. The reading components involve- phonics, phonemic awareness, fluency, vocabulary, and comprehension. This review of the literature specifically aimed to understand which part of reading comprehension is associated with solving math word problems.

Research has shown that there is a significant and positive relationship between reading comprehension and mathematical skills (Vilenius-Tuohimaa et al., 2008; Boonen et al., 2013;

Schaffner & Schiefele, 2013; Bullen et al., 2020). Mckee, (2012) and García-Madruga et al. (2014) found that reading comprehension was a strong predictor of mathematical skills. They explained this as a cognitive skill that supported students' smooth understanding of mathematical concepts and problem-solving (García-Madruga et al. 2014).

Math word problems bridge the gap between reading and math concepts, where students encounter real-life scenarios. Students are expected to read the questions carefully to understand the context, relationships, and relevant pieces of information, comprehend the problem statement by identifying the key details, and apply the mathematical concepts and operations to solve the problems.

Reading Comprehension and Math Word Problems

There is evidence that students struggle to find the correct approach for tackling word problems. Morales (2006) investigated the reasons behind the challenges that students face when working on word problems. Morales' research used a short questionnaire followed by an interview session. The research focused on faculty members teaching mathematics courses to non-mathematics major students in one of the private universities in the Kingdom of Saudi Arabia. The questionnaire was administered to 18 math teachers, followed by an interview session in two parts based on the questionnaire’s results to investigate the reasons why students feared math word problems from teachers' perspectives. They found that students had difficulty in solving math word problems, specifically in understanding the scenario, identifying the requirements, and choosing the appropriate mathematical equations to solve the problem. In 2008, a study conducted by Vilenius-Tuohimaa, P.M., Aunola, K., & Nurmi, J.-E with 225 fourth-grade children aged nine and ten years, evaluated their text comprehension and math word problem solving performance. They categorized participants as good readers or poor readers

based on their technical reading skills. The results showed that performance on math word problems was strongly related to their performance in reading comprehension. Another study conducted by Pongsakdi, Kajamies, Veermans, Lertola, Vauras and Lehtine (2020) investigated the characteristics of word problems and their relationship to solving math word problems. Their study involved 891 fourth-grade students from elementary schools in Finland. It was conducted in two phases. In the first phase the investigation was on characteristics of word problems concerning linguistic and numerical factors and their difficulty level. In the second phase, text comprehension and arithmetic skills were used to categorize the participants into four groups: skillful in text comprehension but poor in arithmetic; poor in text comprehension but skillful in arithmetic; extremely poor in both the skills; very skillful in both the skills. The results showed that the performance in solving word problems on both easy and difficult items was strongly related to text comprehension and arithmetic skills.

Impact of Second Language in Solving Math Word Problems

Since solving word problems in math relates to the reading comprehension of the language in the word problem, research has been done to understand if there are any impacts on the association between a second language and solving math word problems. Bautista, Mitchelmore, and Mulligan (2009) examined factors affecting young Filipino students' word problem-solving capacity in addition and subtraction when the word problems were read aloud in English versus when it was read in the Filipino language. They found that students struggled to understand and solve word problems when they could not understand the language. Cummins et al. (1988) investigated the difficulty children experienced with word problems based on language ambiguity. This included 38 first-graders, 36 second-graders and 36 third-graders. Through their research, they also found that there was a strong association between the skills to find correct

solutions to word problems and strong reading comprehension skills. Another study conducted by Fatmanissa and Maria N.R. Novianti (2020) in Indonesia investigated the role of language in math word problems. The study was done with 44 university students for whom English was a foreign language. The students were provided with ten Postsecondary Education Readiness Test (PERT) math word problems. The problems were modified based on a framework of language factor in the test to reduce the linguistic complexity. Students' written work was compiled and graded followed by an interview to investigate the linguistic challenges in solving the word problems. They found that students with a low English skill benefited more from the modification in the language of the word problem, gaining a better score.

Visualizing **the Scenarios**

Visualization is a reading strategy that creates *mind movies* while reading or listening to a story or scenario. It is one part of solving mathematical scenarios using mental manipulatives without any concrete manipulatives. There is evidence which suggests that there is a correlation between *visualization* strategies and solving math word problems. Hegarty and Kozhevnikov (1999) found that some visual-spatial representations promoted problem-solving success. This was evident in Yin's study (2010) with 50 fifth-and sixth-grade students, where she provided them with six-word problems with a high degree of visuality and difficulty. She found that students preferred to use visual methods in solving novel problems and non-visual methods for solving familiar problems. A visual method was more useful for the students to solve novel problems because students were able to connect the elements of the word problems through visualizing the scenario and then applying their mathematical calculation knowledge to solve it. Montague, Bos, and Doucette (1991) conducted another study in which they researched eighth-grade students solving problems and found that students with learning deficiencies differed

significantly from high and average-achieving students in terms of the quality of problem representation strategies. Interviews with the students revealed that high and average-achieving students imagined themselves in the problem or drew pictures to solve it whereas students with learning deficiencies responded that they did not use visualization to help them. In 2002, Van Garderen and Montague conducted a study with sixth-grade students exploring students' use of visual imagery while solving mathematical problems including students with learning disabilities, average achievers, and gifted students. Their results found that gifted students used more visual-spatial representation than the other two groups, whereas students with learning disabilities used significantly more pictorial representation than their peers.

Retelling the Story

Retelling is an activity that helps students focus on their understanding and challenges them to share their understanding with someone. *Retelling* can be used as a tool for improving comprehension as well as for assessment. In math, retelling can be used as a tool to understand students' comprehension of a given story problem, to restate the steps to follow or to elaborate their understanding with reasons to solve a mathematical problem. The relationship between math story problems and retelling strategies includes multi-step comprehension, solution approaches, cognitive resources, and the context in which the problems are encountered. One of the approaches to retelling a story and organizing their understanding is by using the beginning, middle, and end (BME) graphic organizer. This strategy can be used to logically sequence the events in a story problem and develop their critical thinking skills (Appendix A). Verschaffel (1994), conducted research with 40 fifth-graders who were asked to solve and retell a set of one-step comparison problems. The study aimed to understand the difficulties students face when solving word problems related to *representation* and *comparison*. A key component of their

model was *consistency hypothesis*, in which students were most likely to make errors when the usage of the vocabulary in the relational statement of a compare problem was inconsistent with their preferred format. The result based on accurate data and retelling data displayed evidence in support of the *consistency hypothesis*. They found that considering students preferred format while designing math word problems was more effective than the new or unfamiliar vocabulary. They also found that retelling and the overall understanding of the story problem were affected by the correct usage of vocabulary. Cutler and Monroe (2006) researched oral retellings as solutions for word problems related to comparison. They did the study with 29 sixth-graders (14 boys and 15 girls) from two classes. During the research, the students participated in four 30-minute instructional periods, took a pretest, completed posttest and a delayed posttest. The purpose of the study was to understand how oral retellings influenced their problem-solving approach. In their research they found that when a problem was provided with inconsistent wording, students found it more challenging than problems with a consistent structure. Students who were able to translate the inconsistent words to consistent language were able to display their understanding. To understand the role of language, Trance (2013) conducted a study at a college in the Philippines with engineering students to explore the difficulties they face while solving mathematical algebraic word problems. Students were provided with the word problems and were asked to solve them orally. They had to orally explain their understanding of the problem and the process they intended to find the solution, before providing any written solutions. They found that 62% of errors were related to comprehension. Through oral retelling students were able to express their understanding on their experiences and thought process in solving the math word problems. This helped the researcher to gain understanding of the errors made by the students and extra support was provided to address the specific difficulties.

Theory of Change

The theory of change for this study is that if I practice the reading comprehension strategies with students during the literacy program and integrate them into instruction for comprehending math word problems, students will demonstrate increased participation in analyzing the word problems and applying correct mathematical operations in solving math word problems.

Context

The study was conducted in a public school located in a large suburb area of Seattle in Washington. It had 556 students in grades K-5 with a student-teacher ratio of 15;1. The school has a diverse student body with 45% Asian, 31% White, 11% Latino, 2% Black and 0% Native American children. According to state test scores, 82% of these students are at least proficient in math and 84% in reading *(Home-Sunny Hills Elementary School,2024)*.

For first-grade, the literacy program takes place before lunch hours and the math program takes place after lunch hours. In the literacy program students receive 10-15 minutes of minilessons by the teachers, 30 minutes of independent work and guided reading groups, 10 minutes of phonemic awareness lessons, and 30 minutes of success block. For the math program the school district follows the Eureka math curriculum. The component of the learning includes 3-5 minutes of fluency daily, 5-10 minutes of application problems for 3-5 times a week, 10-15 minutes of concept development daily, 10 minutes of problem set practice daily, and 5-10 minutes of debriefing and exit ticket daily.

Methodology

Design

This action research study of first-grade students in a classroom setup studied the effects of the implementation of a variety of reading comprehension strategies to help students to understand math word problems, decode the mathematical language, and use computation skills to solve them to display their understanding. The desired focus was on monitoring the progression of the students based on the implementation of several strategies.

Baseline data was collected on reading components and mathematical skills to understand if there was any connection between the reading comprehension and solving mathematical word problems.

Before the introduction of any new strategy to solve the math word problems, data were collected as a pre-assessment to understand students' prior knowledge of the concept. During the implementation of strategies, several methods were used to measure students' understanding of the concept as a formative assessment. After the implementation of the strategies, students' learning was assessed through several ways as a summative assessment. This functioned as a reflection to understand the effect of the implementation of the strategies.

Records were maintained on student participation and assessments. Individual student conferences were conducted as needed to better understand the learning style and the areas to work on as well as strategies to reflect on.

Students' voices were included during the lessons and for self-reflection. The results of the engagement of the students during the lessons and the assessment data collected were shared with the grade-level team members, and peer reflections were considered to review the strategies and analyze the results during the action research cycles.

Participants

A group of 18 first graders were identified as the target group for this action research. One of these students had an IEP, two had 504 plans, and two students received ELL support in which they got pulled out of class every day for 30 minutes of practice during the assigned literacy program time. For the research, participants were informed that the work they completed in the class would be used as one form of data collected and if they did not want their work used, they could communicate with me or with the class teacher.

Intervention

The study lasted for four weeks and was integrated with ELA and math lessons every day. There was no change to the classroom schedule or routine. Throughout the research period emphasis was given to the vocabulary of strategies like *visualize* and *retell*. Initially the plan was to focus on one strategy at a time, however; the students got into a routine of using both the strategies at the same time to comprehend their understanding and use their computation skill.

Each day before learning a new concept in mathematics, students were provided with application problems which were word problems related to addition. The proficient readers were able to read the questions by themselves. To support the emerging readers, I read the question aloud. Every time before students started their math problem solving process, I reminded them to visualize the problem, retell it to their elbow partner, use mathematical drawings, solve it using appropriate mathematical operations, and share their method and answer with their elbow partner. *Visualization* and *retelling* were also used during our literacy lessons to repeat stories like *Peter's Chair,* Keats (1967), *Caps for Sale*, Slobodkina (1963) and visualizing the poem *Did You See What I Saw,* Winters (2001). Students were constantly reminded of the strategies to comprehend their understanding of the topics.

Data Gathering Instruments/Assessments

Assessment #1: i-Ready Diagnostic

This assessment is a computer adaptive achievement assessment and was recorded during the beginning of the fall term. This assessment was intended to measure the reading level and the math level of the students at the beginning of the year and allows teachers to understand which skills the students have mastered or are yet to master. This assessment helps teachers to provide classroom tools and support to individual students. Students completed this assignment in a period of two to three days, dedicating about an hour a day. I used the assessment results to find out if there were any relationships between reading components and math skills for the students at an individual level (Appendix C).

Assessment #2: Observation and Records

A journal was maintained by me for a period of three weeks and the records were made based on the observation of participation of the students in the classroom for math lessons and exit ticket after every lesson. The reading intervention strategies were implemented in the whole group, small groups as well as during one-on-one support sessions to read the math questions, visualize them, retell them, comprehend them, and use mathematical drawings to display their understanding and solve them using mathematical operations (Appendix D).

Assessment #3: Student Work Sample Assessment

This assessment was a paper pencil method and was used to measure students' prior knowledge on the topic through student work samples and was used as a pre-assessment as well as formative assessment throughout the studies. Based on their level of understanding, interventions were provided to comprehend the word problems –*visualization* and *retelling strategies*. During everyday lessons in reading as well as in math, the strategies were

implemented, and the records were maintained. Eventually, a formative assessment was executed to check students' understanding and learning through different ways. After practicing the strategies for a couple of weeks the students were provided with a summative assessment and a self-assessment rubric (Appendix E and F)

Action Research Cycles

During the research and practicing the word problems, I noticed that some students just looked at the numbers and used the ongoing math operation concept to solve the word problems. In the process of the research, I made some changes in my strategies for practicing and solving the word problems. I followed the following steps:

- I asked students to close their eyes. I did not display the word problem. I read the word problems one sentence at a time and asked the students to visualize what they heard.
- Shared their visualization with their elbow partner. Also, shared which word, phrase. or sentence they used to visualize their thought.
- Used their visualization and displayed their math drawing for the question.
- Used their math drawing to retell the question to their elbow partner and discussed which mathematical operation to be used and why.
- Drew a number bond and wrote the number sentence to solve the question.
- Shared their answer with their elbow partner.

I used the combination of *visualization* and *retelling* strategies to ensure that the students comprehended the word problems and solved them using correct mathematical operations.

Results

Students completed their diagnostic tests for both reading and math and I compared the students' knowledge levels in both the subjects with the initial assessments and used the data to understand if there is any relationship between reading comprehension and math word problems. According to the final numbers obtained from the i-Ready Diagnostic test, it has been noted that 88.11% of the results displayed the same level in both the subjects, whereas 11.11% of the results did not match (Appendix C).

For the first three days of the research period, students were introduced to the lessons and the learning targets for each. I used the strategy *I do, we do, and you do,* to complete each lesson. Students practiced the concept in their problem set. After the lesson, they demonstrated their understanding through exit tickets. These strategies were practiced for the literacy time for two weeks. Before introducing any intervention strategies, I gave the students a pre-assessment by posing the question: *There are 4 red flags and there are 5 white flags. How many flags are there altogether?* For this question 44.44% of students displayed results which were above the standard grade-level as they were able to explain their procedure to solve the question in detail with me. 33.33% of students displayed results meeting standard grade-level in solving, as they were not able to present their understanding to me in detail. One of the students did the complete procedure correctly; however, while explaining her reasoning, she said she liked to do addition which is why she did addition to solve the problem. Another student said that since it is the current topic being taught in class, that is the reason he did addition. 22.22% of students displayed the results below standard grade level. They only drew a few drawings, some of which did not match the question.

The strategy of *retelling* was integrated and practiced everyday while solving the word problems. A formative assessment was taken after practicing a few lessons (Appendix E). A question was given, and the students were reminded to solve it using the *retelling* strategy in their brain. The question was: *There are 6 cats on the mat and 2 dogs on the bed. How many animals are there in the room?* For this question 77.77% of students displayed results above standard grade-levels, 22.22% of students displayed results meeting standard grade-levels, and 0% of the students demonstrated below standard. When comparing the two records, there was a significant growth in solving the word problem with appropriate explanation and comprehension after the intervention through the *retelling strategy.*

A mid-module assessment was done after lesson 14 and the results were recorded (Appendix D). From the record, it was clear that most of the students struggled to solve the questions, where the questions were not posed directly but students must comprehend the questions and use computation skills to solve them. For one of the questions (Appendix G), they had to look at the picture and write two number sentences for the picture using the concept of 'addition'. 22.22% of students displayed results above standard grade-level. They were able to explain their thinking using pictures and numbers. 55.55% of students displayed the results meeting standard grade-level. They solved the questions accurately, however; struggled a little bit while explaining their work. Lastly, 22.22% of students solved the question partially and needed support to understand the question. The students who struggled to solve the question were because in the question along with the picture numbers were also given. Students got confused while building a relationship between the drawing and the given numbers. For another question (Appendix H), 38.88% of students displayed the results above standard grade level, 22.22% of students displayed results meeting standard grade level, and 50% of students

displayed results below standard grade level. Students found it difficult as it had three different parts, and they all were connected to one main question. To analyze which students', need more support, I used the data from the exit tickets and mid-module assessment. As a result of the assessments, I provided them with access to Zearn lessons to practice the learned concepts at home too so that they could continue to grow these skills outside of class. After this analysis, we revisited those questions as a whole class and went over the mistakes that were made overall. For the next class I pre-assessed them with another question: *There were 7 blue birds and 6 yellow birds on a tree, 4 more red birds join them. How many birds are there in the tree?* Since this question has three numbers, many students got confused as they were trying to solve it. Only 16.66% of students displayed results above standard grade-level, 27.77% of students displayed results meeting standard grade-level, where they tried to attempt the question with their prior knowledge, and 55.55% of students displayed below standard grade-level. I had a discussion with those students who displayed above standard grade-level results, and they said that they used the *retelling strategy* to solve it. The students who only met standard, said they used the *retelling strategy* but got confused with three numbers so did not try more.

Next, I introduced the *visualization strategy* during the morning time for literacy lesson through a poem *Did You See What I Saw.* I integrated the strategy for math word problems and practiced it for four lessons using the *I do, we do, and you do* process. During my observation in the class, I noticed that some students enjoyed the strategy and used their visualization skills to make their math drawings and solved the question with correct mathematical operations. On the other hand, some students were still struggling to convert their visualization into math drawings to support their thinking. I took a formative assessment to check on the students' understanding and application of their learning, asking the students: *There were 8 chocolate cupcakes and 5*

strawberry cupcakes at the party, Joe got 6 more vanilla cupcakes. How many cupcakes are there at the party? (Appendix F) I was amazed to see the results. 55.55% of students displayed results above standard grade-level and 44.44% of students displayed results meeting standard grade-level with very few mistakes. As per my observations, I was still not sure whether all the students were using the strategies taught in class to solve the word problems or just guessing based on the numbers to solve the word problems. Thus, I made some changes in the application of the strategies. Rather than displaying the question under the document camera, I asked the students to close their eyes and read the word problems one sentence at a time and asked the students to visualize what they heard, share their visualization with their elbow partner, and share which word, phrase, or sentence they used to visualize it. I told them to use their visualization and display their math drawing for the question on their white board. Using their math drawing, they were supposed to retell the question to their elbow partner and discuss which mathematical operation to be used, draw a number bond, and write the number sentence to solve the question. Finally, they should have shared their answer with their elbow partner. I used the combination of *visualization* and *retelling* strategies to make the students comprehend the word problems and solve them using appropriate mathematical operations. From lesson 25 to lesson 37, while incorporating the strategies practiced in class, the students displayed immense growth. Records of their exit tickets were maintained and by lesson 37, there were 0% of students performing below grade level. I did a summative assessment including two questions (Appendix J) and a self-assessment rubric (Appendix K). I explained the rubric before giving the assessment to the students and reminded them of all the strategies that we practiced. The first question was: *Nicholas bought 9 green apples and 7 red apples. Sofia bought 10 red apples and 6 green apples. Sofia thinks she has more apples than Nicholas. Is she right? Choose a strategy you have*

learned to show your work. Then, write number sentences to show how many apples Nicholas and Sofia each have. 66.66% of students displayed above standard grade-level with all correct steps and explanations, 33.33% of students displayed meeting grade-level and there were 0% below grade level. The second question was: *There were 4 boots by the classroom door, 8 boots in the hallway, and 6 boots by the teacher's desk. How many boots were there all together?* For this question 88.88% of students displayed results above grade level, 11.11% students displayed results meeting grade-level and 0% of the students were below grade level. After analyzing the self-assessment rubric 61.11% of students agreed that they used either one of the strategies (*retelling or visualization*) to solve the questions, 22.22% of students agreed that they used both the strategies, and 33.33% of students agreed that they used other strategies like number bonds, math drawings or number sentences to solve the word problems. The module was wrapped up with an end-of-module assessment including all the material from the entire module. 16.66% of students displayed results above grade level who attempted all the questions correctly with proper explanation. 77.77% of students displayed results at grade level where they solved all the questions correctly but displayed minor errors in explanation. Finally, 5.55% of students displayed results below grade level who did some wrong calculations and lacked explanation at certain places.

Case Study 1: My daughter is not hesitant of solving word problems anymore. The moment she works on a word problem, she reminds herself that she must apply the strategies. She takes a deep breath and reads the questions at least three times in her mind. She visualizes the story and draws a math drawing, retelling the word problems to me or to herself. She is more confident in solving the word problems now than she was before applying these strategies.

Case study 2:

During the whole research process, I observed that students realize that there can be integration of different subjects into a single topic. Students enjoyed the process of *visualization* and *retelling* the math word problems to their partners. Continuously reminding the students to apply the strategies before solving the word problems greatly impacted their way of thinking and application of the correct mathematical operations.

Conclusions

Before the study began, the i- Ready report study indicated that there was a relationship between my students' reading comprehension and their demonstration in competency with math word problems. Students who were not able to read or comprehend their reading, demonstrated hesitancy in solving math word problems. Their confidence in solving math word problems seemed to shift once the study was completed. More students demonstrated increased confidence in attempting to solve the word problems. At the beginning of the study, some students were identified displaying below standard grade-level, once the study was over there were no students who displayed the result below standard grade-level.

During the first week of study more students displayed results below grade-level standard in solving math word problems, when they only read the questions by themselves or when I read aloud for them. During week four more students started participating in solving the word problems and displayed results meeting standard grade-level or exceeding the standard grade-level.

The results support the idea that there is a strong association between reading comprehension and solving math word problems. Practicing the reading comprehension

strategies of - *visualizing* and *retelling* can influence the students' participation and develop their analyzing skill to solve math word problems.

Limitations

There could be differentiated instructions based on a student's second language; however, it was outside the scope of this specific study.

Recommendations

One recommendation would be to investigate the implication of students' comprehension skill based on their primary spoken language. Another recommendation would be using differentiated instructional language to develop critical thinking skills while posing math word problems. Finally, the last recommendation would be to conduct a study that includes the entire grade levels rather than just one classroom of from it.

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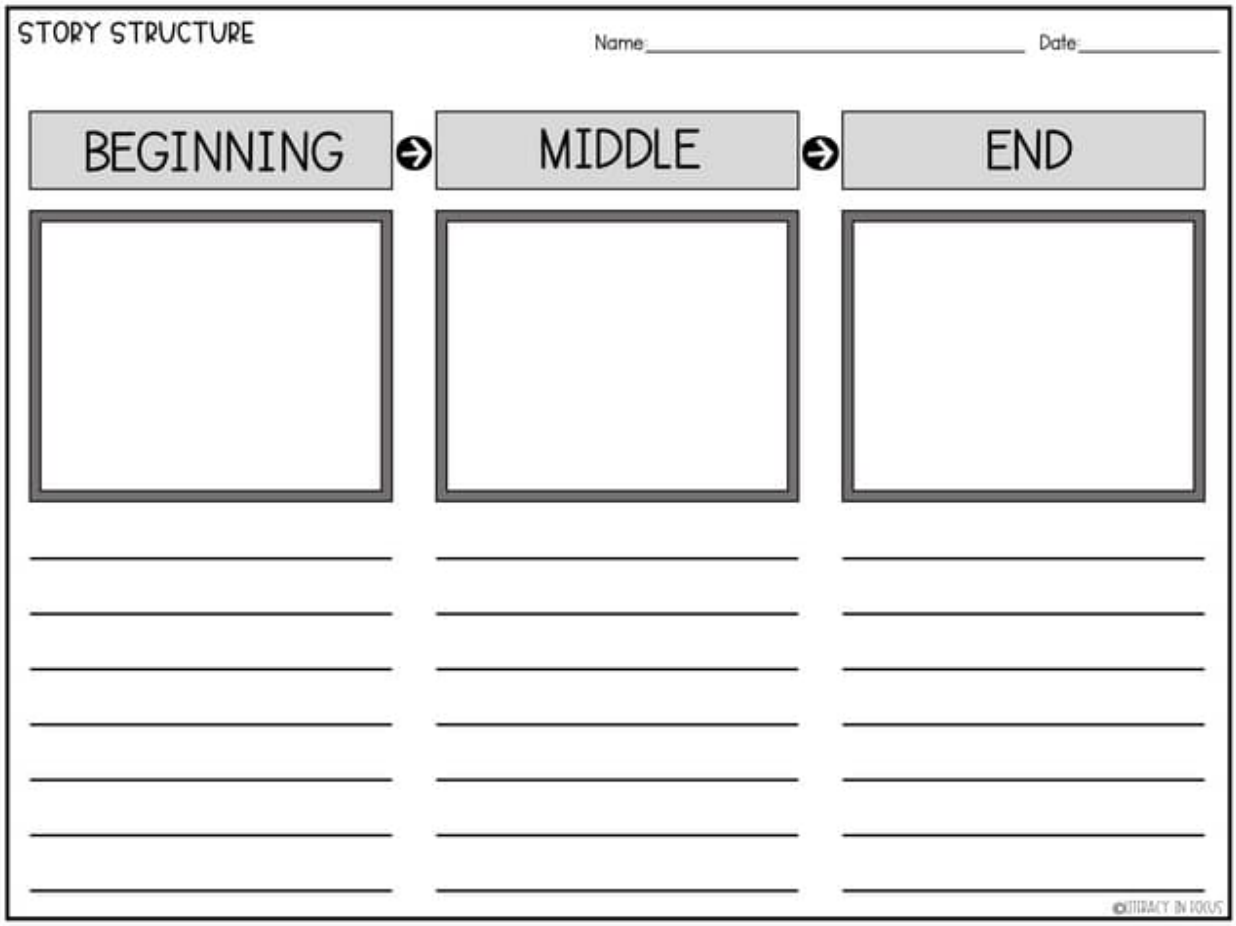
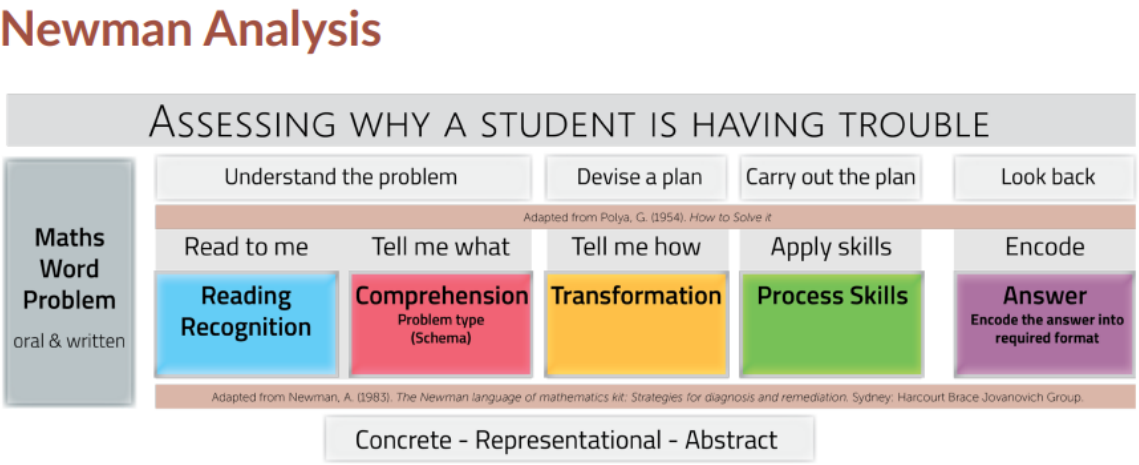
Appendix A

Title of Item



Appendix B


Newman Analysis
ASSESSING WHY A STUDENT IS HAVING TROUBLE
Maths Word Problem
oral & written
Understand the problem
Devise a plan
Carry out the plan
Look back
Adapted from Polya, G. (1954). How to Solve it
Read to me
Tell me what
Tell me how
Apply skills
Encode
Reading Recognition
Comprehension
Problem type (Schema)
Transformation
Process Skills
Answer
Encode the answer into required format
Adapted from Newman, A. (1983). The Newman language of mathematics kit: Strategies for diagnosis and remediation. Sydney: Harcourt Brace Jovanovich Group.
Concrete - Representational - Abstract

Appendix C

Grade: 1

Number of students: 18

Number of boys: 10

Number of girls: 8

Name of the students	Second language	Reading Level	Math Level
DB	No	Mid 1	Grade K
ND	Yes	Grade K	Gade K
JF	no	Mid 1	Mid 1
GF	no	Grade K	Grade K
BF	Yes	Emerging K	Emerging K
KF	No	Grade K	Grade K
RH	yes	Mid 1	Mid 1
AJ	yes	Mid 1	Mid 1
LK	no	Grade K	Grade K
KM	no	Mid 1	Grade K
JO	yes	Grade K	Grade K
AN	no	Grade K	Grade K
LO	yes	Grade K	Grade K
LP	yes	Grade K	Grade K
DP	yes	Grade K	Grade K
AS	yes	Grade K	Grade K
RS	no	Mid 1	Mid 1
JW	yes	Grade K	Grade K

Appendix D

Math Module 1 (Exit tickets and Mid Module assessment)

: all correct : with complete support : missed

: self -corrected when minor mistakes were pointed. : absent

Name of the students	ET7	ET8	ET11	ET12	ET14	Mid Module assessment Pg:1	Mid Module assessment Pg:2	Mid Module assessment Pg:3	Mid Module assessment Pg:4	ET20	ET25	ET26	ET32	ET35	ET37
DB															
ND															
JF															
GF															
BF															
KF															
RH															
AJ															
LK															
KM															
JO															
AN															
LO															
LP															
DP															
AS															
RS															
JW															

Appendix E

Strategy: Retelling

Mathematical Concept: addition 0-20

Name of the students	**Preassessment:** There are 4 red flags and there are 5 white flags. How many flags are there altogether?	**Formative assessment:** There are 6 cats on the mat and 2 dogs on the bed. How many animals are there in the room?
DB		
ND		
JF		
GF		
BF		
KF		
RH		
AJ		
LK		
KM		
JO		
AN		
LO		
LP		
DP		
AS		
RS		
JW		

Appendix F

Strategy 2: Visualization

Mathematical Concept: Addition 0-20

Name of the students	Preassessment: There were 7 blue birds and 6 yellow birds on a tree, 4 more red birds join them. How many birds are there in the tree?	Formative assessment: There were 8chocolate cupcakes and 5 strawberry cupcakes at the party, Joe got 6 more vanilla cupcakes. How many cupcakes are there in the party?
DB		
ND		
JF		
GF		
BF		
KF		
RH		
AJ		
LK		
KM		
JO		
AN		
LO		
LP		
DP		
AS		
RS		
JW		

Appendix G

3. Look at the party picture!

a. Write at least two different addition sentences using 3, 6, and 9 that describe the party picture.

_____ _____

b. How are these number sentences the same? Explain using pictures and numbers.

Appendix H

4. Monica says that when the unknown is 4, it makes this number sentence true: 5 + 3 = ___ + 4. Terry says she is wrong. He says 8 makes the number sentence true.

   a. Who is correct? Explain your thinking using pictures, words, or numbers.

   b. Monica says that 3 and 5 is equal to 5 and 3. Terry says she is wrong again. Explain who is correct, using pictures, numbers, or words.

   c. Next, Monica tells Terry 8 = 8. Terry says she is wrong one more time. Explain who is correct, using pictures, numbers, or words.

Appendix I

End of Module Assessment

Name of the students	Page 1	Page 2	Page 3	Page 4	Page 5	Overall
DB						
ND						
JF						
GF						
BF						
KF						
RH						
AJ						
LK						
KM						
JO						
AN						
LO						
LP						
DP						
AS						
RS						
JW						

Appendix J

Summative Assessment

Name of the students	word problem 1 Nicholas bought 9 green apples and 7 red apples. Sofia bought 10 red apples and 6 green apples. Sofia thinks she has more apples than Nicholas. Is she right? Choose a strategy you have learned to show your work. Then, write number sentences to show how many apples Nicholas and Sofia each have.	word problem 2 There were 4 boots by the classroom door, 8 boots in the hallway, and 6 boots by the teacher's desk. How many boots were there altogether?	Strategies used: Visualization, retelling, both or any other
DB			Both
ND (little support in reading)			Visualization
JF			Retelling
GF			Visualization
BF (support in reading)			Retelling and math drawing
KF			I did addition
RH			It's easy for me, I know it
AJ			Visualization
LK (support in reading)			Both and number bond
KM			Both
JO			Visualization
AN (support in reading)			Number bond and math drawing
LO			Both
LP			Visualization and math drawing
DP			I did addition, I know it
AS			Visualization and math drawing
RS			Math drawing
JW			I used number bond

Appendix K

Self-Assessment Rubric

Criteria	 **YES**	 **CONFUSED**	 **NO**	 **WITH SUPPORT**
I can read the word problem by myself				
I can retell the story to myself				
I can draw the related mathematical drawing				
I can solve the word problem				
I can write the number statement				

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