

METHODS TO IMPROVE STUDENT ABILITY IN SOLVING MATH WORD  
PROBLEMS

by

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## CHAPTER ONE: INTRODUCTION

When one thinks of doing math, initial thoughts may involve working with numbers and symbols to find answers to problems. Often, math is believed to have less of a language burden than other content area classes (Chamot & O'Malley, 1994). The reality is, however, that there is a large amount of language that math students must attend to in order to understand and solve math problems. This makes learning math for English Language Learners (ELLs) even more challenging since they are working toward mastering both basic language proficiency as well as the specialized language needed for mathematics (Spanos, 1993).

In order for students to do well in the mathematics classroom and on standardized tests, it is necessary for them to understand the language of math. For non-native speakers of English, developing the academic language of mathematics is especially challenging. Much of the work that is done in the classroom and items on standardized math tests are in the form of math word problems. These problems contain specialized math language that makes comprehension and solving a challenge for ELLs.

I am an ESL teacher who collaborates with mainstream fourth-grade teachers in the areas of reading and mathematics. I work with both ESL and mainstream students, doing whole class instruction and also working with students individually and with small groups. In the four years that I have been teaching, I have noticed that many ELLs struggle with comprehending and solving math word problems. In my experience, students rarely really attempt to understand the word problem. At best, they look for key

words in the text like “total” and then add numbers together. This strategy is limited, however, because looking for key words does not always work to the students’ advantage. At worst, I have seen students locate numbers in word problems and perform a mathematical function with them without knowing why or if what they are doing makes sense.

As a teacher in the classroom, I have seen ELLs struggle with understanding and solving math word problems. Many students I have worked with over the years have had problems comprehending math word problems. They are often unable to translate the words into number sentences in order to calculate the answers to math word problems. I have seen them grapple with language that determines meaning in seemingly simple problems such as *How many more apples does Jane have than Peter?* This example of *how many more...than* is just one of many language related challenges that ELLs face while learning the academic language of mathematics. In my experience, students have been confused by the wording of this type of problem and only seem to fully understand how to solve a *how many more...than* problem after explicitly being taught that they must subtract the smaller number from the larger number. This lack of understanding has led me to search for ways to help students comprehend such problems and solve them with more accuracy.

In terms of standardized testing, ELLs tend to score lower than their native English-speaking peers. In fact, a congressionally-mandated study reported that ELLs not only tend to receive lower grades, but they are also judged by their teachers to have lower

academic abilities and score below non-ELLs on standardized tests in both reading and mathematics (Moss & Puma, 1995).

Of all content areas, ELLs struggle most with mathematics and tend to score the lowest on state and national standardized math tests (Basurto, 1999; Martiniello, 2008). Standardized tests in math consist primarily of word problems that students must interpret before they are able to compute answers. It remains unclear whether these problems are answered incorrectly due to a lack of understanding of the language used or because of errors in computation. Because of the lack of understanding that ELLs may have of mathematical word problems based on their limited English proficiency, it is difficult to know whether their math abilities are being fairly assessed (Martiniello, 2008). Therefore, for students and schools to be successful in learning and teaching mathematics, the language of math word problems must be addressed.

Specifically, math language is challenging in word problems because the text is dense and concept-loaded. Short texts are used to convey larger meaning, which must be read carefully for accurate comprehension of the problem to be solved (Basurto, 1999). Some researchers even consider math texts to be a distinct genre for which special reading comprehension strategies must be taught to ensure accurate understanding (Winograd & Higgins, 1994/1995).

Research supports that math language is semantically and syntactically specialized. Math makes use of its own specific and specialized vocabulary such as *denominator* and *quadrilateral* (Rubenstein & Thompson, 2002). Furthermore, students must learn phrases used in mathematics and learn to distinguish between them. A student

must know that 6 *divided into* 12 will yield a completely different result than 6 *divided by* 12 (Heinze, 2005; Irujo, 2007). Math language also makes use of syntactic features such as comparative structures, passive voice, and logical connectors that can be a challenge for ELLs when reading math text (Chamot & O'Malley, 1994).

In addition, ELLs may lack the background knowledge necessary to fully comprehend math word problems (Barwell, 2001; Short & Spanos, 1989). Word problems that ask students to calculate the number of fish in a catch or the amount of change someone would receive with the fewest number of coins assume some cultural knowledge about fishing and American money. It adds to the complexity of solving math word problems for ELLs. It is also problematic because children without access to or experience with this culturally specific information are at a disadvantage when trying to solve these types of math word problems.

This chapter introduces my plan to scaffold the teaching of students to write their own word problems as a method of increasing these students' comprehension of word problems and their ability to successfully solve them.

#### Role of the Researcher

I have been an ESL teacher for four years. I work in collaboration with two fourth- grade mainstream teachers in the areas of reading and math. I have always been more comfortable teaching reading. The teaching of reading naturally involves teaching language, which I am most prepared to teach. When I began teaching math, I struggled to find my role. Language is also a part of math, but how to teach language while teaching math content wasn't something that I knew how to do quite as naturally. The one obvious

area in math where language is especially important is in comprehending math word problems. I wanted to research how I could help my students grapple with the language that they need to be successful with these types of problems. This is why I decided to devote my research to finding out if teaching students a procedure to follow in solving word problems and helping them to write their own word problems would help them perform better in this area.

I work with a small group of ELLs during a time allocated for “interventions.” I thought this would be the perfect chance to help these students become more proficient at comprehending and solving math word problems. It is for these students that I designed and carried out my research project.

#### Background of the Researcher

I have felt frustrated with the limited amount of time that the current math curriculum spends on developing the strategies necessary to comprehend and solve math word problems. For that reason, I sought to better understand how to help ELLs comprehend and solve word problems in their math classes. I wanted to try teaching students to write their own word problems as a way to help improve their performance.

I believed that students would be motivated to learn how to solve math word problems by writing their own. Winograd (1992) states that by having students write their own word problems, they are more receptive to receiving problem-solving instruction from their teachers. I hoped to encourage my students in the same way.

I used pre- and post-tests in my study in which students were asked to solve word problems, and later were asked to solve number sentences that corresponded to the

aforementioned word problems. A bias I had before I began my research was that I believed that students would be able to solve the number sentences more accurately than the corresponding word problems. That is to say, I believed that the challenge in solving math word problems lies in difficulty with comprehending the language more than in the basic computation of the number sentences.

### Guiding Questions

In this paper I will explore the overriding question of how I can help ELLs to better comprehend and solve math word problems. In terms of my own teaching, I wanted to know how I could scaffold the process of teaching students to write their own math word problems to see if this strategy could help them to comprehend word problems better, to see if this process would help students solve these problems with more accuracy, and investigate how teaching students to write their own word problems might help them to talk about how they solve them more proficiently.

### Summary

In this chapter, I have focused on the importance of comprehending the language of math word problems for ELLs. These students are expected to solve math word problems in order to succeed in their math classes and to do well on standardized tests. Due to the nature of the language found in word problems, additional strategies may be needed to help ELLs fully comprehend that language. My aim was to work with students to help them comprehend and solve math word problems with more accuracy. Working toward this aim, I scaffolded the process of teaching students to write their own math word problems to help them comprehend and solve these types of problems more

accurately. In addition, I strived to help ELLs talk about how they solved math word problems.

### Chapter Overviews

In Chapter One I introduced my research by establishing the purpose, significance and need for the study. The context of the study was briefly introduced as was the role, assumptions and biases of the researcher. The background of the researcher was also given. In Chapter Two I provide a review of the literature relevant to the language of math word problems and how helping students write their own word problems may help ELLs to comprehend and solve these word problems better. Chapter Three includes a description of the research design and methodology that guides this study. Chapter Four presents the results of this study. In Chapter Five, I reflect on the data collected. I also discuss the limitations of the study, implications for further research and recommendations for teachers of ELLs in the content area of math.

## CHAPTER TWO: LITERATURE REVIEW

The purpose of this study is to explore how I can help ELLs to better comprehend and solve math word problems. In terms of my own teaching, I wanted to know how I could scaffold the process of teaching students to write their own math word problems to see if this strategy would help them to comprehend word problems better, to see if this process would help students solve these problems with more accuracy, and investigate how teaching students to write their own word problems might help them to talk about how they solve them more proficiently. Chapter One identified the problem ELLs have with understanding what math problems mean and then being able to accurately solve them.

This chapter presents an overview of the specialized language of mathematics and why this language poses particular difficulties for ELLs. Word problems are challenging for ELLs both semantically and syntactically. Furthermore, many ELLs lack culturally specific background knowledge that would assist them in relating to problems. This chapter also discusses other research that has been done to teach students to write their own math word problems as a way of increasing their ability to solve such problems. Finally, the need to use direct teaching and scaffolding to help students author their own word problems is addressed.

### The Language of Math Word Problems

When one thinks about math, symbols and numbers usually come to mind. The idea that math is very rich in language may not seem apparent at first. The reality,

however, is that math language is very specialized. In fact, mathematics has its own distinct language register that makes use of specialized vocabulary and syntax (Kang & Pham, 1995). Native speakers of English and ELLs alike must learn this special language of math in order to be successful in mathematics. The language of mathematics is especially challenging to ELLs, who are learning this academic language alongside the social language they need for the purpose of basic communication. The complexity lies primarily in the dense nature of math text, and also in the learning of the semantics and the syntax of the mathematical register (Kang & Pham, 1995).

#### Math Word Problems as a Genre

Winograd and Higgins (1994/1995) and also Barwell (2003a) categorize the language of math word problems as a genre. In Barwell's article (2003a), he mentions features that make math word problems a distinct genre. One feature specific to math word problems is they have a three-part structure, including a "set up" to explain the scenario of the problem, a number of pieces of information about that situation, and finally a/some question(s) at the end. Another specific feature mentioned by Barwell is that one may use the same scenario, but change the information given about it and therefore be able to formulate word problems that illustrate different mathematical concepts.

Concept-loaded problems. One characteristic making math text a genre is that mathematics text is loaded with concepts. Because word problems are short in length, meaning is densely concentrated into a few words. Unlike other genres of text, word problems have little context and lack repetitions and rewordings, such as paraphrasing,

that students usually use to make sense of information in other types of text (Kang & Pham, 1995). For this reason, students are unable to use the reading comprehension strategies they have learned to decipher other genres in order to comprehend these word problems (Irujo, 2007). They must, therefore, learn to read math word problems as a genre all its own. Because reading comprehension is so crucial to solving math word problems effectively, instruction in the reading of mathematics texts is important for ELLs. However, according to Kang and Pham (1995), this instruction is usually not focused on in the math classroom.

The concept-loaded nature of math text requires the reader to read more carefully, and at a slower rate than other types of reading (Heinze, 2005) and may require multiple rereadings (Kang & Pham, 1995). Students who are not aware of how to read mathematics text may have difficulties. The use of language and concept-loading makes reading math word problems more difficult for ELLs (Basurto, 1999).

Interestingly, math word problems are often referred to as “story problems.” While they do give a brief situation, they hardly tell a story. This can be seen in the following problem:

*Sam’s truck weighs 4,725 pounds. The truck can carry 7,500 pounds of rocks.*

*What is the total weight of the truck and full load?*

A real story would give more background information about who Sam is and what his job is that requires him to haul heavy loads of things in his truck. A real story would paraphrase and use repetition to make sure that students understand the meaning of the word “load” in the story (Spanos, 1993).

Semantics of mathematics. Another characteristic of math as a distinct genre is semantics. First of all, math makes use of a very specific and specialized vocabulary. Words like *denominator*, *quadrilateral*, *parallelogram*, and *isosceles* are special terms only found in the context of mathematics that math students must learn in order to be successful (Rubenstein & Thompson, 2002). Lexical items such as *divisor* and *quotient* must be learned in order for students to carry out division problems. Not only are these words important to learn, but of equal importance are phrases within mathematical expressions. The phrase *divided by* gives a completely different equation than the phrase *divided into* (Heinze, 2005). For example, 6 *divided by* 12 is 0.5, whereas 6 *divided into* 12 is 2 (Irujo, 2007). These subtle yet important distinctions are important yet difficult for ELLs to recognize.

Also, there are multiple ways to refer to the same function in mathematics. For example, words referring to the function of addition include *sum*, *add*, *plus*, and, *combine*, and *increased by*. Students must not simply learn one term, but all related terms to be able to fully comprehend math text. (Chamot & O'Malley, 1994; Heinze, 2005).

Additionally, there is the issue of polysemy, or diversity of meanings, in the lexicon of mathematics. Words that are used in common speech can also be used for a specific purpose in mathematics. Students may be familiar with the common uses of words like *quarter*, *remainder*, and *place*, but these words have a different meaning when used in mathematics. (Chamot & O'Malley, 1994; Heinze, 2005). Students may know the various meanings of *right* in everyday uses such as the *right* answer or one's *right* hand,

but must assign the word *right* a different meaning in the mathematical term *right angle* (Rubenstein & Thompson, 2002).

Some words used both in math and everyday English have similar meanings, but the meaning in math is more specific. For example, the word *difference* in everyday English denotes a general comparison, while *difference* used as a math term has the more precise meaning of the subtraction of two numbers (Rubenstein & Thompson, 2002).

In addition, sometimes the same mathematical word is used in more than one way within the field of mathematics itself. The word *round*, for example, can refer to the shape of a circle or the function of rounding a number to the nearest tenth. Likewise, the word *square* can refer to a shape and also to a number times itself (Rubenstein & Thompson, 2002).

To add to the complexity of math language, some mathematical terms are homonyms of words used in everyday English. *Sum* and *some*, *arc* and *ark*, *pi* and *pie* are some examples of words that students may confuse (Rubenstein & Thompson, 2002).

Syntax of mathematics. Syntax is another characteristic making math its own genre. It is well documented that math language makes use of certain syntactic structures. This is summed up in Table 2.1. In addition to the syntactic features listed in the table, other features that can be problematic include relative and subordinate clauses (Short & Spanos, 1989). Pronouns used to refer back to referents (Heinze, 2005) can also be challenging if learners have not mastered the English pronoun system. For example, in the following problem where *them* is used to refer back to *toy cars* and *she* is used to refer back to *Rachel*.

*Rachel had 17 toy cars. She gave 11 of them away. How many toy cars does she have now?*

Table 2.1

*Syntactic Features of Word Problems*

1. Comparatives	greater/less than $n$ times as much as as...as	6 is <i>greater than</i> 4 Maria earns <i>six times as much as</i> Peter. Lin is <i>as old as</i> Roberto.
2. Prepositions	divided into divided by by	4 (divided) <i>into</i> 8 10 <i>divided by</i> 5 2 multiplied <i>by</i> 6 (x) vs. x exceeds 2 <i>by</i> 7 (+)
3. Passive voice		$x$ is <i>defined</i> as a number greater than 7 When 5 is <i>added</i> to a number, the result is 7.
4. Reversals		The number $a$ is five less than $b$ . Correct equation: $a = b - 5$ or $b - a = 5$ Incorrect equation: $a = 5 - b$ or $a - 5 = b$
5. Logical connectors	if...then	<i>If</i> $a$ is positive <i>then</i> $-a$ is negative.

Note. From from *CALLA Handbook: Implementing the cognitive academic language learning approach*, p. 230 by A. Chamot and J.M. O'Malley, 1994, MA: Addison-Wesley Publishing Company.

### Mathematical Language Difficulties for ELLs

While math word problems are a source of difficulty for non-native English speakers and native English speakers alike, there are reasons that such problems are especially challenging for students whose native language is not English. These reasons include teacher misconceptions about the language burden of mathematics and a lack of culturally specific background knowledge. These barriers often result in non-native

English speakers scoring much lower on standardized math tests than their native English-speaking peers (Moss & Puma, 1995).

### Misconceptions

Research indicates that teachers believe that mathematics does not involve as much language as that of other content areas (Chamot & O'Malley, 1994). Other authors address the claim that mainstream teachers believe that ELLs do not need to learn as much language as they need to learn math symbols and how to manipulate these symbols (Kang & Pham, 1995). As has been supported in the previous section, this is simply not true. The language demands of mathematics can be quite challenging.

The truth is that there is a heavy language burden in mathematics. Students learning English do not need less language in the mathematics classroom, but rather more (Kang & Pham, 1995). Students who are working toward English proficiency need to master both basic language proficiency as well as the special register necessary to be successful in mathematics (Spanos, 1993). Because of this misunderstanding of the language burden for ELLs, many teachers limit the teaching of math to computation exercises instead of problem solving efforts in English because these teachers believe that ELLs cannot be successful in solving word problems until they are more fluent in the English language (Basurto, 1999).

### Background Knowledge

Another reason ELLs might find math word problems difficult is because they have a lack of background knowledge about specific problems (Barwell, 2001; Short & Spanos, 1989). Many math word problems contain culturally specific information.

Students who are not familiar with this information will struggle with understanding and solving these problems. For example, on Minnesota's Sample Fourth-grade MCA test (Minnesota Department of Education, 2009), one question reads:

*Oliver went fishing. He caught 2 pike, 1 muskie, and 3 bass. What fraction of Oliver's total catch was bass?*

Students who lack background knowledge of fishing may find this question confusing. They may be unfamiliar with the names of fish and the term *catch* because here it is used as a noun to mean the group of fish Oliver caught, instead of as a verb, which is its more common meaning.

Students with little prior knowledge about American money may have difficulty answering questions like the following, also from Minnesota's Sample Fourth-grade test (Minnesota Department of Education, 2009).

*Maria gave a store clerk \$10.00 for a purchase that cost \$9.19. How would Maria receive her change using the least number of coins possible?*

Without the knowledge of U.S. coins, students would not be able to successfully answer this question.

### Testing

In terms of standardized testing, ELLs tend to score lower than their native English-speaking peers. Of all content areas, ELLs struggle most with mathematics and tend to score the lowest on state and national standardized math tests (Basurto, 1999; Martiniello, 2008). Because of the lack of understanding that ELLs may have of

mathematical word problems based on their limited English proficiency, it is difficult to know whether their math abilities are being fairly assessed (Martiniello, 2008).

#### Student-Authored Word Problems: The Benefits

Several researchers have advocated for students writing their own math word problems as a way to increase their ability to comprehend and solve such problems, as well as to increase problem solving ability in general (Barwell, 2001, 2003b; Heinze, 2005; Martiniello, 2008; Short & Spanos, 1989; Spanos, 1993; Winograd, 1990, 1992; Winograd & Higgins, 1994/1995). Furthermore, it can have a positive effect on student motivation and interest, it links math to students' personal experience and background knowledge, and allows students and teachers to work collaboratively to create the math curriculum. This is particularly beneficial to ELLs. Linking content to personal experience and background knowledge is especially crucial for non-native speakers of English who are trying to navigate the language of math word problems.

#### Motivation

One reason for learners to write their own math word problems relates to interest and motivation. Students tend to get excited when word problems are about them or their classmates. They have a natural curiosity that can be tapped into during the mathematics class by making the content of word problems more relevant (Winograd, 1995). This curiosity lends itself well to students creating their own word problems. It channels students' wonderings into creating situations of their own. Students who write their own math word problems tend to be more interested in the problem solving process (Winograd, 1995). This leads to a captive audience for teachers, who can provide direct

problem solving instruction to students who are more receptive. Winograd (1992) conducted a case study with mainstream fifth grade students. He observed one class as they wrote, solved, and shared math word problems in small groups. He found that students are more willing to accept problem solving instruction from teachers if that instruction is directly related to solving their self-authored word problems. He also discovered that students tend to write word problems that require more complicated skills to solve than they currently possess. For example, one student wrote a word problem that required her to find the volume of her recorder, the musical instrument the students were learning to play. This created an opportunity for the teacher to teach that student how to solve for volume in order for the student to solve her self-authored word problem.

#### Personal Experience

Because context is important for the comprehension and solving of math word problems (Chapman, 2006), students who have had personal experience with the situations described in the word problems they read will have more success understanding and solving them. When students write their own problems, they make use of contexts and situations with which they are intimately familiar. This helps to alleviate the problem of students having to solve word problems that are culturally unfamiliar to them. It incorporates their background experience so that math word problems are more comprehensible to students.

Generally, when students author math word problems, they tend to include information about their actual experience, their hobbies, information from other content areas, objects in the classroom environment, or they write about topics that come from

their imaginations (Winograd, 1992). Problems written by students are more authentic, because they reflect the background knowledge and personal experience that students bring from their own lives. The use of personal experience in creating math word problems can make problems more meaningful to students (Barwell, 2003b).

### Collaborative Effort

Often times, students are asked to solve only problems they see in their textbook or that have been written by their teacher. By having students write their own math word problems, they are essentially constructing the math curriculum together as a class and with the teacher (Winograd, 1992). Students can share their math problems with the class as a whole group by writing the word problems they created on the board and inviting their peers to solve them. Teachers can also publish student-written word problems on worksheets and ask students to solve their classmates' problems. In this way, students are not only solving problems that adults create for them, but they are also able to solve problems that they create for each other (Winograd, 1992). This is particularly powerful for ELLs.

### Student-Authored Word Problems: The Implementation

Teaching students to write their own word problems can be done in a few different ways in the classroom. Generally, there should be direct problem solving instruction from teachers, teacher scaffolding of the problem writing process, and a component of cooperative learning for students to share and solve their problems.

### Direct Instruction

Much of the research stresses the need for direct problem-solving instruction as students learn to write their own math word problems. Students need to learn a procedure for solving problems (Chamot & O'Malley, 1994; Heinze, 2005; Spanos, 1993; Winograd, 1990). Spanos (1993) has devised an eleven step procedure to help guide students through the problem solving process that he calls Word Problem Procedure (WPP). The following is his list of steps:

1. Choose a partner or partners.
2. Choose a problem. Write the problem in the space below.
3. One student read the problem out loud. Discuss the vocabulary and circle words you don't understand. Write the words below.
4. Use a dictionary for help. Ask your partner or teacher for help.
5. What does the problem ask you to find? Write this below.
6. What should you do to solve the problem? Add? Subtract? Multiply? Divide? Write this below.
7. Solve the problem below.
8. Check your answer below.
9. Explain your answer to your partner(s). Write your explanation below.
10. Explain your answer to the class.
11. Write a similar problem on the back of this page.

When students follow the steps of this procedure, they are able to practice the mathematical academic English in the four modalities: reading, writing, listening, and

speaking. Students are also using math reasoning strategies, applying math concepts, and using social strategies as they work collaboratively (Spanos, 1993).

This procedure is especially beneficial for students with limited English proficiency because it is a means to breaking down and understanding word problems. Spanos (1993) conducted a case study in a high-school ESL math class. When taught the word problem procedure, the students in Spanos' study made progress in solving math word problems even though they had trouble explaining their solutions to such problems. Also, by writing similar word problems, these students were able to focus on the word problem structure and understand in mathematical terms what was required of them.

### Scaffolding

Students also need scaffolding to help them write their word problems (Heinze, 2005; Spanos, 1993; Winograd, 1990; Winograd & Higgins, 1994/1995). At the beginning, teachers can model the process showing students their own teacher-generated word problems created from their own experience. Teachers can discuss how they chose their topics and teachers and students can discuss how these problems could be solved. As students work on solving these teacher written problems, the teacher will provide direct instruction of steps (such as Spanos' WPP) to help students solve the problems. Teachers can then begin to provide students with word problems that contain missing information. Students first provide simple information as they fill in blanks. As time goes on, students provide more information and eventually write an entire word problem on their own.

For example, students could be given this word problem used in Spanos' 1993 study:

*Sam's truck weighs 4,725 pounds. The truck can carry 7,500 pounds of rocks.  
What is the total weight of the truck and full load?*

Students could solve the above problem and then write a similar problem by filling in information and/or numbers into the blanks like this:

*Sam's \_\_\_\_\_ weighs \_\_\_\_\_ pounds. The \_\_\_\_\_ can carry \_\_\_\_\_ pounds of rocks. What is the total weight of the \_\_\_\_\_ and the full load?*

In this way, teachers can scaffold the process by which students write their own word problems. With time, less information could be provided to students until they are able to write entire problems on their own. For example, students can make up problems using different names and vehicle types, and also different loads and weights that the vehicle carries.

Scaffolding the teaching of word problems is an important step. Using old problems to solve new ones helps deepen students' mathematical understanding and helps to integrate the new and old knowledge (Winograd & Higgins, 1994/1995).

### Cooperative Learning

Most of the literature stresses the benefits of students sharing their original problems with their peers (Chamot, Dale, O'Malley, & Spanos, 1992; Chamot & O'Malley, 1994; Hildebrand, Ludeman, & Mullin, 1999; Winograd, 1990). This allows for discussion that will deepen the understanding of math word problems. In fact, Chamot

and O'Malley (1994) claim that when students work together cooperatively to discuss their problems, it is more effective than if they work alone or in pairs.

In some models, students share the problems they write with small groups of students. In other models, students take turns presenting their problems to the whole class (Chamot, et al., 1992; Chamot & O'Malley, 1994; Hildebrand, et al., 1999; Winograd, 1990). In all cases, it is an opportunity for students to hear feedback about the problems they create. It leads small groups or whole class negotiation of meaning about the problem and how best to solve it. The discussion also gives students practice talking about math and using math language.

### The Gap

Clearly, the language burden is great for ELLs in the area of math. With such an emphasis placed on standardized math testing that involves the language of math word problems, teachers need to concentrate on making sure ELLs are able to comprehend and solve such problems. The research suggests that scaffolding the teaching of students to author their own word problems can help students learn to write them. Some benefits of this instruction and some positive results have been reported. More research is needed, however, to find out if ELLs will benefit from learning to write their own math word problems. There has been little research done in this area, and much of the existing research that was done by Winograd (1990, 1992), Winograd & Higgins (1994/1995), and Spanos (1989, 1993) is now a bit dated. I wish to address this gap in the research.

### Research Question

Through my research, I hoped to learn the value of scaffolding the teaching of ELL students to write their own math word problems. Therefore my questions included: Would scaffolding the teaching of students to write their own math word problems help them comprehend these types of problems better? Would this process make the language of math more comprehensible? At the end of my instruction, would students be able to solve math word problems more accurately? Finally, would students be able to talk about how they solved math word problems with greater ease?

### Summary

In this chapter, I have presented information about the specialized language of mathematics and why this language poses particular difficulties for ELLs. Mathematics language is challenging because it has its own distinct semantic and syntactic structure. Word problems in math tend to be highly dense and difficult for ELLs to unpack. Misconceptions that teachers have about the importance of math language and a lack of culturally specific background knowledge required to solve word problems make matters even more challenging for ELLs.

I have also included in this chapter a look at other research that has been done to teach students to write their own math word problems as a way of increasing their ability to solve such problems. Benefits to ELLs in writing their own math word problems include increased motivation and interest, a greater link to personal experience and existing background knowledge, and collaboration between students and teachers to collectively write the math curriculum.

### Chapter Three Overview

Chapter Three gives a detailed account of the methods used to conduct my research. It also includes information about the participants, the setting, and techniques for data collection and analysis.

## CHAPTER THREE: METHODOLOGY

This study was designed to explore how to help ELLs better comprehend and solve mathematical word problems. In this study, I wanted to find out how teachers could scaffold the process of teaching students to write their own math word problems, to see if teaching students to write math word problems would help them to comprehend word problems better, and also to learn if this process would help students be able to solve math word problems with more accuracy. Lastly, I wanted to investigate if teaching students to write their own word problems would help them to talk about how they solve math word problems.

First, I gave a pre-test using selected word problems from the Sample Fourth-Grade MCA Math Test (Minnesota Department of Education, 2009). To find out if teaching students to write their own word problems helps students comprehend word problems and talk about how they solve a problem, I used tape-recorded think-aloud verbal reports as students solved a word problem. Finally, in order to discover if teaching students to write their own word problems helped students to solve word problems with more accuracy, I conducted a post-test using different selected word problems from the Sample Fourth-Grade MCA Math Test (Minnesota Department of Education, 2009).

### Overview of the Chapter

In this chapter I will describe my use of a mixed method research paradigm. In addition, I will give information about the participants, the setting, and my techniques for data collection and analysis.

### Mixed Method Research Paradigm

I used both qualitative and quantitative research to explore my research questions. According to Dörnyei (2007), this combination of qualitative and quantitative research is referred to as “mixed methods research.” It allows the researcher to combine the rich, deep, and descriptive data of qualitative research with the more objective, number-driven data of quantitative research. I think that using both methods gave me more well-rounded data and that my findings were more valid.

The pre- and post-tests I administered were quantitative. The pre-test score was compared with the post-test score to determine if progress had been made in comprehending and solving math word problems. Qualitative research was conducted by administering think-aloud reports. This data allowed me access to student thinking as they solved math word problems. I also kept a teacher journal that provided me with additional insights.

### Data Collection

#### Location/Setting

This study was completed in a small urban Midwest elementary school. The student population is around 450 students. Sixty-one percent of the students receive free or reduced lunch. About twenty-five percent of the student population is Limited English Proficient. The total minority population at the school is fifty-five percent. The school uses a collaborative model for ESL instruction. As the ESL teacher, I work within the two fourth-grade classrooms where ELLs are clustered. I work collaboratively with the

mainstream teacher during Reader's Workshop and math to ensure that the curriculum is accessible to ELLs.

Data was collected during a daily thirty-minute small group designed as an intervention for both reading and math. Students received instruction in reading four days during a six-day rotation and in math two days per six-day rotation. ELLs were chosen to participate in this group based on Measures of Academic Progress (MAP) scores from the fall of the 2010-11 school year that show they do not meet or partially meet state standards in reading and/or math.

### Participants

The participants in this study were six fourth-grade ELLs. The level of English proficiency of the students is intermediate based on the Test of Emerging Academic English (TEAE) scores in reading and writing and also Student Oral Language Observation Matrix (SOLOM) evaluations.

The TEAE is an exam that ELLs are required to take each year. It consists of two parts; one to assess reading ability and the other to assess writing ability. The SOLOM is a rubric completed by ESL teachers that assesses listening and speaking abilities. The six students I have chosen are primarily Spanish-speaking and have been educated in the U.S. school system from one and a half to five years. Table 3.1 gives more specific information about these students.

Table 3.1

*Student Data*

Student	Home Language	Amount of Time in U.S. Schools	Fall 2010 MAP Math Score	SOLOM Score 2010	TEAE Score 2010
1	Tibetan	5 years	206	4	Reading, 2 Writing, 3
2	Arabic	1.5 years	Not available	Not available	Not available
3	Spanish	5 years	201	3	Reading, 3 Writing, 4
4	Spanish	4 years	193	3	Not available
5	Spanish	5 years	212	3	Reading, 3 Writing, 4
6	Spanish	4 years	194	3	Reading, 3 Writing, 4

Pre- and Post-tests

To begin with, I needed to find out how well students solved word problems to get a baseline of their proficiency. Therefore, my first data collection method was a pre-test using MCA-II math word problems from the fourth-grade sample test posted online by the MN Department of Education (Minnesota Department of Education, 2009). To discover if students had improved in their ability to solve word problems, I gave them a post-test, with different math word problems from the same MCA-II fourth-grade sample test. The scores from the two tests were compared to see if students improved their scores.

### Think-Aloud Protocol

McKay (2006) outlines the use of the think-aloud as a way of gaining access to students' thinking as they complete a task. Students are asked to complete a task, which in my study was reading and solving a math word problem. As students are working on their task, they are prompted by the teacher to verbalize what they are thinking. I recorded students as they solved a math word problem, and then transcribed the sessions for later analysis. My reason for conducting think-alouds with students was to see if there was greater understanding in the comprehension of math word problems. Learning what they comprehend or do not comprehend of a word problem can only be accomplished by listening to the thoughts of students as they solve problems.

### Procedure

#### Participants

ELL students were chosen to participate in this group based on MAP scores from the fall of 2010 that show they only partially met state standards in reading and/or math. The purpose of the group instruction was to help these students become more proficient in reading and math to eventually meet the state standards. The participants were first given a pre-test to determine a baseline of ability to solve math word problems. Following the pre-test was ten weeks of instruction focused on learning a Word Problem Procedure for solving word problems. As part of the procedure, students learned through a scaffolded process to write their own word problems. At the end of the ten-week instruction period, participants individually participated in a think-aloud, where they

solved a math word problem while explaining how they were solving it. Finally, a post-test was administered to check for improvement in solving math word problems.

### Procedural Steps

Pre-test. First, I gave participants a pre-test using five selected word problems taken from the Sample Fourth-Grade MCA Math Test (Minnesota Department of Education, 2009). The participants completed this written pre-test during the small group intervention time. After collecting students' papers, I then gave them these same five problems written in number sentence form in a different order on a separate paper. See Appendix A for the pre-test.

After correcting the two written parts of the pre-test, I compared each word problem with its number sentence counterpart for each student and recorded scores to reflect the number of word problems correctly answered and the number of number sentence problems correctly answered. The five word problems I selected represented at least one addition, one subtraction, one multiplication, and one division problem to assess a variety of mathematical functions.

Table 3.2

*Example of word problem and corresponding number sentence*

*Example word problem:*

Last year a basketball player scored 513 points. This year he has scored 466 points. How many more points must he score to have the same score as last year?

*Corresponding number sentence:*

$$513 - 466 = \underline{\hspace{2cm}}$$

Test items were framed in both formats so that I could see which format students struggled with the most. My assumption was that students would answer the word problems with less accuracy and the number sentence problems with more accuracy. By comparing the two formats, I was able to see if students were struggling with the language in the word problem, computation, or both.

Instruction. I instructed the group of participants in a small group setting over a ten-week period. The small group met daily, but focused on math an average of one day per week for 30 minutes each session. In all, the group received a total of 12 sessions of instruction totaling six hours focused on solving word problems.

I began by teaching students a revised version of Spanos' Word Problem Procedure (WPP) (Spanos, 1993). The steps of this procedure I used with the students were the following:

1. Read the problem out loud.
2. Talk about the vocabulary and circle words you don't understand. Write the words below.
3. Ask your partner or teacher for help with what these words mean.
4. What does the problem ask you to find? Write it below. (What question does it ask you?)
5. Draw a picture to represent the problem.
6. What should you do to solve the problem? Add? Subtract? Multiply? Divide? Write this below.
7. Solve the problem below.

8. Check your answer.
9. Explain how you got your answer to your partner. Write what you said below.
10. Explain your answer to the rest of the group.
11. Write a similar problem on the back of this page.

I first modeled how to follow steps one through ten with a few problems so that students knew what is expected of them. We discussed how using these steps would help them solve math word problems. Once the participants understood the process, I then assigned students to partners and gave each set of partners a word problem to solve. Students used the WPP to solve their word problem and discuss with the group how they solved it.

Once students were using steps one through ten with more confidence, I introduced the final step (Write a similar problem on the back of this page.) that asks students to write their own word problem.

I scaffolded the process of writing word problems by using a word problem that students had solved already using the WPP. The problem is as follows:

*Sam's truck weighs 4,725 pounds. The truck can carry 7,500 pounds of rocks.*

*What is the total weight of the truck and full load?*

I then gave students a copy of the problem, leaving blanks for them to fill in the numbers which were missing. The problem looked like this:

*Sam's truck weighs \_\_\_\_\_ pounds. The truck can carry \_\_\_\_\_ pounds of rocks. What is the total weigh of the truck and full load?*

Together as a group, we discussed changing the numbers and practiced solving the problem with new sets of numbers. Finally, I gave them the following version of the same problem:

*Sam's \_\_\_\_\_ weighs \_\_\_\_\_ pounds. The \_\_\_\_\_ can carry \_\_\_\_\_ pounds of \_\_\_\_\_. What is the total weigh of the \_\_\_\_\_ and full load?*

As a group, we discussed different vehicle choices and also options for different loads. Students re-wrote the problem choosing one of the options we generated together. Students took turns reading their new problems aloud to the group and we practiced solving them, also together as a group.

Instruction continued this way with a few more problems, with partners of students solving word problems using the WPP, and eventually writing their own version of the problem with more and more information being provided by students.

Think-aloud. After completing instruction, I administered a think-aloud individually to the participants. My goal was to see if the instruction was effective in increasing their comprehension of math word problems. I recorded, transcribed, and then analyzed their responses.

To analyze the think-aloud data, I used a checklist of strategies from the WPP to code what students did and said during the think-aloud. My main goal was to see if students were using the strategies they learned while using the WPP.

Checklist:

Circled words he/she didn't understand / Discussed unfamiliar vocabulary

- Discussed what the problem was asking them to find
- Drew a picture to represent the problem
- Discussed the function needed to solve the problem (addition, subtraction, multiplication, division)
- Solved the problem correctly
- Checked his/her answer

Teacher journal. During the ten weeks of my study, I recorded my observations and reflections in a journal. This provided anecdotal information about the process the participants were going through in my study such as how they were using and reacting to the WWP.

Post-test. At the end of instruction, I gave the participants a post-test similar to the one they took before the instruction period began. I recorded these scores and compared them to the pre-test scores, looking for improvement. The post-test format was the same as the pre-test, in that I gave students five word problems to solve, and then the same problems written in a number sentence form. See Appendix B for the post-test.

I compared each word problem with its number sentence counterpart and recorded scores to reflect the number of word problems correctly answered and the number of number sentence problems correctly answered. The five word problems I selected represented at least one addition, one subtraction, one multiplication, and one division problem to assess a variety of mathematical functions.

## Materials

Pre-test. I gave my participants a pre-test using selected word problems from the Sample Fourth-Grade MCA Math Test (Minnesota Department of Education, 2009) before I began instruction. The pre-test had two different forms; one form had word problems, and the other form had number sentences that corresponded to the word problems on the first form. See Appendix A for the pre-test.

Post-test. I administered a post-test using selected word problems from the Sample Fourth-Grade MCA Math Test at the end of the ten-week instruction period. The post-test also has two different forms; one form had word problems, and the other form had number sentences that corresponded to the word problems on the first form. The two forms of the post-test contain different problems than those found on the pre-test. See Appendix B for the post-test.

## Data Analysis

The pre- and post-tests were scored to see how many items students answered correctly. For both the pre-test and the post-test, I compared how students scored on each word problem versus its number sentence counterpart. I also compared pre-test scores to post-test scores to check for overall improvement. At the end of the ten-week instruction period, I re-read my teacher journal and found common themes and insights. To analyze the think-aloud data, I used a checklist of WPP strategies I taught students. For the checklist, please refer to pages 33 – 34. My aim was to see if students were actually using the steps they had learned in the procedure and if those steps were helpful to them when solving a problem.

### Verification of Data

To ensure the conclusions of this study were supported by sufficient data sources, I have chosen to use quantitative as well as qualitative data collection methods. To develop a baseline of students' ability to solve math word problems, I administered a pre-test and later a post-test to determine progress made after the instruction period. I also recorded observations in a teacher journal and through that was able to compile insights about how the students responded to and learned from the instruction. I also administered think-alouds with individual students to see how students were applying the word problem procedure to solve problems. It was by using all of these data collection methods that I came to my final conclusions.

### Ethics

This study employed the following safeguards to protect informant's rights:

1. Parent permission was obtained before beginning my research.
2. Names of participants, school, and teachers were changed in my paper.
3. Students' test scores and recorded think-aloud sessions and their transcriptions will be destroyed six months after the study has been written up.

### Conclusion

In this chapter, I described the methods I used to carry out my research. I described my use of a mixed method research paradigm. In addition, I gave information about the participants, the setting, and my planned techniques for data collection and analysis. Finally, I outlined the steps I took to make sure my research was done in an ethical manner. In Chapter Four will I will present the results of my study.

## CHAPTER FOUR: RESULTS

This chapter presents the results of the post-test, teacher journal, think-alouds, and post-test of my study. I also include a discussion of how pre- and post-test scores compared to each other. The data I collected helped to answer the overarching question of how can I help ELLs to better comprehend and solve math word problems. Specifically, I wanted to know how teachers could scaffold the process of teaching students to write their own math word problems, if teaching students to write math word problems would help them to comprehend word problems better, and if this process would help students be able to solve math word problems with more accuracy. Lastly, I wanted to investigate if teaching students to write such problems would help them to talk about how they solve math word problems.

### Pre-test Results

The participants in the study began by taking a pre-test before I began the instruction focusing on solving math word problems. I gave participants a pre-test using five selected word problems taken from the Sample Fourth-Grade MCA Math Test (Minnesota Department of Education, 2009). The participants completed this written pre-test during the small group intervention time. After collecting students' papers, I then gave them these same five problems written in number sentence form on a separate paper. See Appendix A for the pre-test.

For all students, the scores for the word problem portion of the test were lower than their scores for the corresponding number sentence portion. This tells me that

students were able to compute number sentence problems with more accuracy than they were able to comprehend and solve word problems. For some students, like Student 1 and Student 5, their ability to solve both the word problems and number sentences was fairly accurate already. The other students had a more pronounced difference between their scores for the word problems and number sentences. The participants' pre-test scores can be seen in table 4.1

Table 4.1

*Student Pre-test Scores*

<b>Students</b>	<b>Word Problem Score</b> (Number correct out of 5)	<b>Number Sentence Score</b> (Number correct out of 5)
1	4	5
2	2	5
3	3	5
4	1	3
5	4	5
6	1	5

Teacher Journal Results

During the ten weeks of instruction, I recorded my thoughts and observations about how students were responding to the word problem instruction. After the instruction period was completed, I looked back through my journal, searching for common themes and insights in my comments. The themes I found included the effectiveness of analyzing vocabulary and drawing pictures. Another common theme was in noticing how difficult it was for students to explain verbally how they arrived at their answers. Finally, I wrote about how pleased I was to see the students so engaged and motivated while using the WPP and writing their own word problems.

One thought that I had involved analyzing the vocabulary in a word problem. In one example I wrote about, we were working on the following problem:

*9 children are coloring in class today. They have 3 dozen colored pencils. If they divide the pencils up equally, how many pencils will each of them get?*

While working through the WPP, I found out that a few students did not know the meaning of the word *dozen*. Without this knowledge, it would have been impossible to solve the problem. We talked about what dozen meant, giving examples of things that come by the dozen like eggs, doughnuts, etc. The students were then able to proceed with the problem and solve it correctly. It is really important for students to analyze the vocabulary of word problems carefully. One word can make the difference in getting the correct answer.

Another insight that I gained from my notes was that drawing a picture to represent the word problem really seemed to help students to comprehend and solve it. For example, during one class period students were working on the following problem:

*Grandmother is teaching us how to sew. She has 30 yards of yarn, and she wants to give each of us 4 yards. How many of us can she give yarn to, and how much will she have left?*

This was a very difficult problem for all of the students. There was a lot of discussion about what the problem was asking us to find and how to solve it. It was not until we drew a picture of the yarn and started cutting it up into sections of four yards each that students were able to visualize the problem well enough to solve it. Over the weeks of instruction, students used the strategy of drawing a picture to help them comprehend

different problems. It was a very effective tool for them. This was especially true of the students who had lower word problem scores on the pre-test.

Another insight I had during this process was noticing how difficult it is for students to explain verbally how they got their answers. I kept noting that we needed to spend more time verbalizing mathematical thinking and processing. If I had had more time in my study, this is one area that I would have expanded. Helping ELLs to practice this is a really important way to help them develop their math as well as their oral language skills.

One other common theme I wrote about in my journal was about how pleased I was to see the students so engaged and motivated while using the WPP and writing their own word problems. The WPP was such a helpful tool for students because it gave them steps to follow which ultimately led to the successful solving of word problems. It was especially helpful for the more emergent math students to have a formula to follow. These were the students who, at the beginning of instruction, did not know where to start when solving a word problem. The WPP gave them a path to successfully answering questions. In addition, I noticed how engaged students were as they were writing their own word problems. For once, they were not just handed a problem to solve. This was different for them because they were able to create something that was theirs. For example, we were working on a problem that read:

*In our living room, we have 9 vases. There are 7 flowers in each vase. How many flowers do we have in our living room?*

After talking about other types of receptacles to replace the vase and other objects that each receptacle could hold to replace the flowers, students wrote their own word problems. They were really excited about being able to choose the options that they wanted. One student chose to use 15 refrigerators and 12 cartons of ice cream. Another student chose 20 baskets and 6 teddy bears. As each student came to the front of the group to sit in the special chair to share their problem, I could tell that they were proud of their problem and were really anxious for their peers to solve it. In fact, they tended to choose more challenging numbers for their problems, which encouraged the math calculations to get more difficult.

#### Think-aloud Results

I conducted think-alouds with the participants of the study. The think-aloud was done with each student individually. Each student was given a paper with a math word problem written at the top and a pencil. The problem was the following:

*Mary went to the store and bought 7 boxes of crayons. Each box had 12 crayons in it. How many crayons did Mary buy in all?*

The instructions were to solve the word problem on the paper I provided as the participant told me what he/she was thinking and doing while solving the word problem. I began recording each participant and he/she solved the problem. I asked questions to prompt him/her to explain what he/she was doing or explaining as she/he solved the problem.

After all the recordings were complete, I transcribed the think-alouds. See Appendix D for these transcriptions. Next, I coded the transcriptions using a checklist to

assess what students did/said. For this checklist, please refer to pages 33 – 34. I looked at each student's transcription individually, making tallies for each item from the checklist that they had used. I made notes about each item for each student for further observations about what students had said or done. Finally, I compared each student's tallies and notes, looking for patterns that I could use to summarize the information from all of the think-alouds in general.

None of the students did the first item on the checklist (Circled words he/she didn't understand / Discussed unfamiliar vocabulary). There appeared to be no unfamiliar words in the word problem that presented an issue for any of the participants.

Addressing item two on my checklist (Discussed what the problem is asking you to find), all of the students had an understanding of what the problem was asking them to find, but only two students (Students 3 and 5) explicitly stated the question that the problem required them to answer. The other participants showed their understanding in other ways like drawing a picture or ultimately finding the correct answer to the problem. Student 3 was confused in attaching a label to her answer of 84, first saying "boxes" and then changing her label to "crayons." This suggests that her understanding of what the problem was asking her to find perhaps was not as clear as some of the other students.

The third item on the checklist was "Drew a picture to represent the problem." Three students (Students 2, 4, and 6) drew a picture that consisted of seven boxes to represent the boxes of crayons with either the number "12" or twelve tally marks to represent the number of crayons in each box. One student (Student 3) wrote a column of 12s seven times to show that there were seven boxes of crayons with twelve crayons in

each box, but did not draw the boxes. The last two students (Students 1 and 5) did not draw pictures, but instead directly went to writing the number sentence of  $12 \times 7$ .

It should be noted that the two students who did not draw pictures were the same students who had high scores on the word problem portion of their pre-test. The other students who either drew pictures or wrote  $12 \times 7$  had lower scores on the word problem portion of the pre-test.

The fourth item on the checklist was “Discuss the function needed to solve the problem (addition, subtraction, multiplication, division).” All students ultimately decided that the function needed to solve their problem was either multiplication or repeated addition, which is essentially the same as multiplication. Some students decided upon the function and discussed their reasons why more confidently than others. Students 1, 2, and 5 were able to express the function they used confidently. Student 4 did not explain the function she used, but showed that she needed to use repeated addition clearly in the work she did on her paper. Students 3 and 6 were not confident about which function to use to solve the problem. Student 3 first said she needed to multiply, and then said she should add. When asked why, she said she thought she should add because the problem used the words “in all.” Usually kids are taught these key words “in all” to mean they should add. I believe that this information from past learning is what confused Student 3 in this case. I prompted her to use her paper to do whatever she needed to solve the problem. It was at this point that she wrote seven 12s on her paper and solved the problem using repeated addition. Student 6 first indicated that she should multiply and then changed her mind, saying she needed to divide. I asked the student what she could

do on her paper to figure out what she needed to do. She was able to draw a picture and find the correct solution to the problem. She was, however, still unable to verbalize the mathematical function she had used at the end.

The sixth item on the checklist was “Solved the problem correctly.” All six students were able to successfully solve the problem. Some were faster and more confident than others, but they all arrived at the correct answer in the end.

The seventh checklist item was “Checked his/her answer.” None of the students really did this step. They were all satisfied with their final answer once they had arrived at it.

#### Post-test Results

The study ended with students taking a post-test after I had completed the ten-week period of instruction focusing on solving math word problems. I gave participants the post-test using five selected word problems taken from the Sample Fourth-Grade MCA Math Test (Minnesota Department of Education, 2009).. The participants completed this written post-test during the small group intervention time. After collecting students’ papers, I then gave them these same five problems written in number sentence form on a separate paper. See Appendix B for the post-test.

The participants’ post-test scores can be seen in Table 4.2. For all students, the scores for the word problem portion of the test were the same as their scores for the corresponding number sentence portion, with the exception of Student 3, whose word problem score was 1 point lower than her number sentence score. These scores tell me

that students' abilities to solve word problems were largely equivalent to their ability to compute number sentence problems.

Table 4.2

*Student Post-test Scores*

<b>Students</b>	<b>Word Problem Score</b> (Number correct out of 5)	<b>Number Sentence Score</b> (Number correct out of 5)
1	5	5
2	5	5
3	4	5
4	5	5
5	5	5
6	3	3

All participants in the study showed improvement in their scores on the word problem portion of the tests. Results showing these improvements can be seen in Table 4.3. Student 1 improved by one point, Student 2 improved by three points, Student 3 by one point, Student 4 by four points, Student 5 by one point, and Student 6 improved by two points. The scores for the number sentence portion of the test largely stayed the same, with the exception of Students 4 and 6 who each increased by two points.

I believe that the reason for the increases in the word problem test scores was because of the time instructing students to use the WPP and the time closely analyzing, pulling apart, and changing word problems as students wrote their own math word problems. As students learned the WPP, it was necessary for them to solve each problem in a methodical, step-by-step process. They needed to slow down and read problems more carefully and identify the question the problem was asking them to solve. They were then asked to draw a picture to represent what was happening in the problem. This

was especially helpful for those students with more emergent math skills to visualize the problem. As students were working through these steps, I saw and heard them discussing what problems meant and negotiating meaning with each other. The more emergent students were often only able to determine the math function necessary to solve a problem (multiplication, addition, etc.) after they had drawn a picture and discussed what it meant. I saw that the partners' careful analysis of problems led them to successfully solve such problems.

When we started pulling apart and changing word problems, I began to notice more confidence in students in comprehending the problems they were working with. As we changed problems that students had solved previously, students were asked to understand these problems more deeply than before. They not only had to interpret the problems, but they also needed to think of different options for components in the problems, making sure they still made sense. There were occasions when we were brainstorming ideas together when new components suggested by students did not make sense. The group discussed the ideas and helped to change them. For example, we were working on the problem:

*In our living room, we have 9 vases. There are 7 flowers in each vase. How many flowers do we have in our living room?*

Before students wrote their own version of the problem, we discussed options for the components of *vase* and *flowers* together as a group. Someone suggested we change the problem to how many boxes of ice cream were in a refrigerator. Another student said that you wouldn't find a refrigerator in the living room. We discussed as a group that perhaps

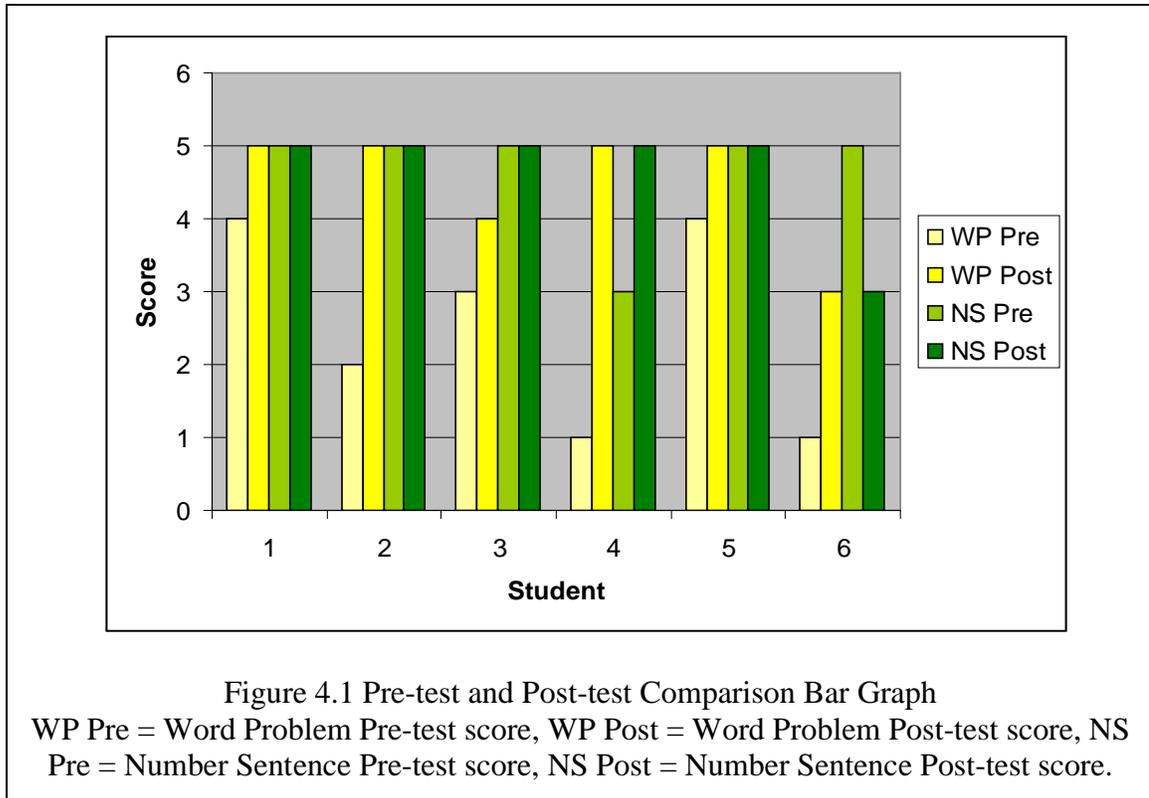
changing living room to kitchen would help this problem make more sense. This example suggests that students were really thinking about the meaning of each problem as they were making changes to it. It is this level of understanding that really helped students comprehend the problem.

Because of these behaviors I saw as students worked through this process, I knew that the instruction phase of this study was clearly time well spent for students to be able to comprehend and solve these types of problems more accurately. I think that more time and attention should be spent in the mainstream classroom working with math word problems in the ways I have done in my research so that ELLs will be able to comprehend and solve such problems.

Table 4.3

*Pre-test and Post-test Comparison*

<b>Pre-test</b>			<b>Post-test</b>		
<b>Student</b>	<b>Word Problem Score</b> (Number correct out of 5)	<b>Number Sentence Score</b> (Number correct out of 5)	<b>Student</b>	<b>Word Problem Score</b> (Number correct out of 5)	<b>Number Sentence Score</b> (Number correct out of 5)
1	4	5	1	5	5
2	2	5	2	5	5
3	3	5	3	4	5
4	1	3	4	5	5
5	4	5	5	5	5
6	1	5	6	3	3



### Chapter Five Overview

In Chapter Five I discuss my major findings, implications for teaching, limitations of the study, professional growth and insight, and recommendations for further research.

## CHAPTER FIVE: CONCLUSIONS

This chapter presents a discussion of my major findings, implications for teaching, limitations of the study, professional growth and insight, and recommendations for further research.

The purpose of my research was to explore how I could help ELLs to better comprehend and solve math word problems. I wondered how scaffolding the writing of word problems would help them to comprehend word problems better. I also wanted to see if this process would help students be able to solve math word problems with more accuracy. Lastly, I wanted to investigate if teaching students to write their own word problems would help them to talk about how they solve math word problems.

### Major Findings

One major finding from the research was that, overall, the WPP was a helpful tool for all students to use while solving math word problems, but different steps of the procedure seemed to be most beneficial to students based on their level of math problem solving ability. I found that the step which required students to draw pictures to represent math word problems was a beneficial strategy for all students, but was especially useful for the students that had lower scores on the word problem portion of the pre-test. I saw these students that struggled in their ability to solve math word problems as the more emergent students in the study based on their math ability. During the instruction phase of the research, I made notes about this fact in my teacher journal. In talking with these emergent students about how to solve problems, it was not until they drew a picture to

represent the problem that they were able to go on to successfully solve it. Also, I noticed this strategy being particularly helpful during the think-alouds. The more advanced math students were able to solve the think-aloud problem without drawing a picture. The other, more emergent math students were unable to solve the problem until they drew a picture.

Another interesting finding from the research involves the more advanced math problem solvers who scored quite high on the pre-test. At first, I was concerned that this targeted instruction focusing on math word problems would not be as beneficial for them. I realized as the instruction progressed that these more advanced students were also benefiting from learning the WPP, most specifically the step which requires students to explain their thinking about how they solved a problem. I noticed that the more advanced students usually knew how to solve math word problems with relative ease, but had difficulty explaining how they arrived at their answers. They would simply say, "I'm not sure, I just knew the answer." As we practiced using the WPP more and more, these students improved their ability to explain the steps they took to solve the problem. This oral language practice was beneficial to all the participants in the study.

The final step that asked students to write their own math word problem was beneficial to all of the students. It required students to go beyond the mere reading and solving of word problems, which is what they normally have to do. The dissection and reconstruction of problems that students needed to do to change an existing problem led students to really comprehend those problems more deeply. This was the step, as the literature review indicated in Chapter Two, that really engaged students and got them interested in working with word problems. Students were really excited about creating

problems that were their own. They were proud to share their problems and were also very eager to solve each other's problems. The level of engagement while creating, sharing, and solving student authored math word problems was much higher than when students were simply solving problems that were given to them to solve. As I also mentioned in Chapter Two, when students write their own word problems, it can have a positive effect on student motivation and interest. This activity links math to students' personal experience and background knowledge, and allows students and teachers to work collaboratively to create the math curriculum.

#### Discussion

My initial research question was how I could help ELLs to better comprehend and solve math word problems. I feel that by performing this study I have made some real progress toward answering that question. The instruction involving the teaching of the Word Problem Procedure, including having students write their own word problems suggests improvement in these students' ability to comprehend and solve math word problems.

For students who were already fairly strong in solving these types of problems, their skills were simply reinforced. The most progress was seen in students who struggled with comprehending and solving math word problems.

Looking at my more specific questions, I wanted to know how teachers could scaffold the process of teaching students to write their own math word problems. I saw through my research that slowly leading students through the process was an effective way of scaffolding them. First, they changed numbers of existing problems. Later, they

changed both numbers and other details of a problem until they had their own unique word problem that they could share and solve with their peers.

In another one of my specific research questions, I wanted to see if teaching students to write math word problems would help them to comprehend word problems better. By changing the word problems we had been working with and making the problems their own, the students were able to have a deeper understanding of those problems. Without this deeper understanding, they wouldn't have been able to make the changes that they did. It really made them take a deep look at what was happening in the problems in a way that they wouldn't have had to if they were simply solving them. They had to go a few steps further. This helped them to further their understanding of the problems and solve them with greater understanding and accuracy.

Another research question involved wanting to see if this process would help students be able to solve math word problems with more accuracy. By conducting both a pre-test and a post-test and comparing the scores, I was able to see improvement in all of the word problem scores. This indicates to me that the instruction was successful in helping the participants answer math word problems with more accuracy than they had been able to do before the instruction period began.

In my final specific research question, I wanted to investigate if teaching students to write their own word problems would help them to talk about how they solve math word problems. I learned through the think-alouds that some students were confident in describing the process they went through in order to solve a problem. Other students still found this verbal explanation difficult. It was difficult to assess if there had been any

improvement without having done a think-aloud at the beginning of the instruction phase. In retrospect, that would have given me a better understanding of where individual students were in terms of explaining the thoughts they had while solving a math word problem. Overall, through the course of the instruction, I noticed that most students found it difficult to put into words that which they were thinking about while solving the problems we were working on. I think that this is an area that all ELLs need to improve upon. This should be considered when planning instruction in the mainstream classroom. Time devoted to help ELLs practice oral language as they explain their thinking about mathematical problems would be time well spent.

#### Implications for Teaching

It is clear that teachers need to spend more time during math class teaching a procedure that students can follow in order to solve word problems. Doing so would seem to have great benefits for ELLs, as they are improving their language skills alongside their math problem solving skills. With the rest of the math content teachers are required to teach, there seems precious little time to devote to really delving deeply into word problems. But in doing so, teachers can give their ELLs more chance for success in really comprehending and solving such problems. This can only help them perform better on math assessments that are largely made up of questions in word problem form.

I agree with the findings of Spanos' 2003 research. Students need to learn some kind of procedure in order to successfully solve math word problems. Especially for ELLs, teaching this procedure through direct instruction helps them to break down problems in a systematic way to aid in their comprehension. This means that teachers

would be well advised to spend the time teaching a procedure for their students to follow to help them really understand math word problems.

I also think that the scaffolding process in teaching students to author their own word problems is an important step for teachers to do. In past years, I have seen teachers ask students to attempt to write their own word problems without scaffolding their work. These problems often did not follow the same format that math word problems require, and they often did not make a lot of sense. During my research, however, I saw all students I was working with be successful in writing word problems. I attribute that success to the scaffolding process I used that was recommended by Heinze (2005), Spanos (1993), Winograd (1990, 1992), and Winograd and Higgins (1994/1995) in the literature review. Therefore, teachers should scaffold the process by starting small and working towards having students provide more and more information as they alter an existing math word problem.

#### Limitations of the Study

One limitation of the study was the amount of time I was able to devote to the instruction of math word problems. I feel that I could have had a greater impact if I had had more time to instruct students. In fact, researchers like Winograd advocate for the writing and solving of mathematical problems every day (Winograd, 1992). I feel like the research I conducted barely skimmed the surface largely due to time constraints.

Another limitation is the number of students who participated in my study. If I had been able to include more than six students, I would have been able to collect more data and I would have had a broader scope to my findings. Because I co-teach math in the

mainstream classroom, this setting would have helped to strengthen the work with word problems we did. More students, both native and non-native speakers of English would have provided a richer environment of experience and background knowledge in which to explore, write and solve math word problems. ELLs in this scenario would have also had access to more native English-speaking language models during the process than the teacher.

### Professional Growth and Insights

I feel that I have grown as a result of this experience, both as a teacher and a researcher. Keeping a journal during the instruction phase of the research was especially helpful in this sense. I was able to record and process my thoughts after each class, which helped me become a more thoughtful and reflective teacher. It helped me to plan future instruction better based on the needs of my students.

This research and planning the instruction to help students be more proficient in solving math word problems has helped me to be better equipped in teaching math in the future. As an ESL teacher, I have always felt more competent in teaching my students language. As a result of my research, I now feel that I understand the language demands of math better and that I am better able to help students navigate through these language challenges. With Spanos' Word Problem Procedure, I feel as though I can equip students with the tools they need to comprehend and solve math word problems. I also feel that I can help students engage more and become more motivated in solving word problems by helping them to write their own word problems and share them with others.

### Further Research Recommendations

In my research I had only a limited amount of time to work with students and we worked with a limited number of word problems. I would recommend a longer study that could systematically look at each of the major mathematical functions that word problems usually require: addition, subtraction, multiplication, and division. In addition to learning the Word Problem Procedure, or some variation of it, and authoring word problems, students could be asked to compare and contrast word problems that require these four functions. They could compare language formulas that are used to have an even deeper understanding of these different types of word problems.

In addition to conducting the study over a longer period of time, I would also recommend doing the same research with more students in order to have a larger sample. This larger group could consist of ELLs, or research could also be done in the mainstream classroom. Teaching native and non-native English speakers the WPP would give ELLs more native English-speaking models from whom to learn as students explain their thinking and write and share their own math word problems. It would be interesting research to be able to compare and contrast the process with this different class language dynamic.

## APPENDIX A

### Pre-test questions

## Pre-test Questions

Word problems

1. Last year a basketball player scored 513 points. This year he has scored 466 points.

How many more points must he score to have the same score as last year?

A. 47

B. 57

C. 153

D. 157

2. Jose, Adam, and Dan each bought 9 balloons. What is the total number of balloons the 3 friends bought?

A. 3

B. 12

C. 27

D. 36

3. Dana played a total of 28 soccer games during the months of June, July, and August.

She played 19 games in June and July. How many games did she play in August?

A. 8

B. 9

C. 10

D. 11

4. Kelley made bead necklaces and sold them for \$5 each. She earned \$40. How many necklaces did Kelley sell?

- A. 6
- B. 8
- C. 35
- D. 45

5. Gary read his book on 3 different weeks.  $234 + 234 + 134 = \underline{\hspace{2cm}}$

- On week 1, Gary read 234 pages of the book.
- On week 2, he read the same number of pages as on week 1.
- On week 3, he read 100 pages less than he read on week 2.

What was the total number of pages Gary read?

- A. 334
- B. 468
- C. 568
- D. 602

Corresponding number sentences

1.  $513 - 466 = \underline{\hspace{2cm}}$

A. 47

B. 57

C. 153

D. 157

2.  $3 \times 9 = \underline{\hspace{2cm}}$

A. 3

B. 12

C. 27

D. 36

3.  $28 - 19 = \underline{\hspace{2cm}}$

A. 8

B. 9

C. 10

D. 11

4.  $40 \div 5 =$  \_\_\_\_\_

A. 6

B. 8

C. 35

D. 45

5.  $234 + 234 + 134 =$  \_\_\_\_\_

A. 334

B. 468

C. 568

D. 602

## APPENDIX B

### Post-test questions

## Post-test Questions

Word problems

1. There are 15 students waiting to have their school pictures taken. Each picture takes 3 minutes. What is the total number of minutes it will take for all of these students to have their pictures taken?

- A. 5
- B. 12
- C. 18
- D. 45

2. A school had \$1,000 to spend on a playground. They spent \$651 on a new swing and a slide. How much money does the school have left to spend?

- A. \$349
- B. \$451
- C. \$505
- D. \$651

3. A city has 3 schools.

- There are 633 students in elementary school.
- There are 587 students in middle school.
- There are 740 students in high school.

What is the total number of students in the 3 schools?

- A. 1,850
- B. 1,860
- C. 1,950
- D. 1,960

4. Brad bought 5 sports drinks at the store. He spent a total of \$10.00 on the drinks. How much did each drink cost?

- A. \$1.50
- B. \$1.75
- C. \$2.00
- D. \$2.25

5. Pat and Tracy collected a total of 576 aluminum cans. Pat collected 398 aluminum cans. How many did Tracy collect?

- A. 178
- B. 188
- C. 222
- D. 288

Corresponding number sentences

1.  $15 \times 3 = \underline{\hspace{2cm}}$

A. 5

B. 12

C. 18

D. 45

2.  $1,000 - 651 = \underline{\hspace{2cm}}$

A. \$349

B. \$451

C. \$505

D. \$651

3.  $633 + 587 + 740 = \underline{\hspace{2cm}}$

A. 1,850

B. 1,860

C. 1,950

D. 1,960

4.  $10.00 \div 5.00 =$  \_\_\_\_\_

A. \$1.50

B. \$1.75

C. \$2.00

D. \$2.25

5.  $576 - 398 =$  \_\_\_\_\_

A. 178

B. 188

C. 222

D. 288

## APPENDIX C

Word Problem Procedure (WPP) sheet for students

## Word Problem Procedure

1. Read the problem out loud.
2. Talk about the vocabulary and circle words you don't understand. Write the words below.
3. Ask your partner or teacher for help with what these words mean.
4. What does the problem ask you to find? Write it below. (What question does it ask you?)
5. Draw a picture to represent the problem.
6. What should you do to solve the problem? Add? Subtract? Multiply? Divide? Write this below.
7. Solve the problem below.
8. Check your answer.
9. Explain how you got your answer to your partner. Write what you said below.
10. Explain your answer to the rest of the group.
11. Write a similar problem on the back of this page.

## APPENDIX D

Think-aloud transcriptions

**Student 1**

Reads the problem

S: It's telling me that there's 7 boxes of crayons and there's 12 crayons in each, so we do 12 times 7 and that equals, um...84. 84 crayons.

T: OK, good. So how did you know to multiply?

S: I know because it says in each box there are 12 crayons and there are 7 boxes. So, instead of just counting 12 seven times, I knew that was 12 times 7.

T: So, just the words helped you?

S: Yeah.

T: OK. Any other thoughts you had as you were solving the problem that helped you know what to do?

S: Well, really it was just easy because it was just 7 times 12.

T: OK, well and you are actually correct. Very nicely done.

**Student 2**

(reads the problem)

S: I think maybe to solve the problem maybe there's a way to solve it. Maybe if you do the picture first. I'm doing this before I solve it.

(draws 7 boxes, each with the number 12 inside)

T: So it looks like you're drawing some boxes. And it looks like the boxes have the number 12 inside. What do the boxes show? What do they represent?

S: They represent the crayons. So, I made 7 boxes. If I want to solve it I need to multiply.

T: OK.

S: I will use partial products.

T: Perfect.

(writes  $7 \times 12$  and works out the problem)

S: And then the answer is 84 crayons.

T: Beautiful. Thank you.

### **Student 3**

(reads the problem)

T: Good. So, what do you think you should do to solve the problem?

S: Add.

T: OK. You can write anything you want to on the paper and tell me what you are doing.

S: No, I think I should multiply.

T: Why?

S: I don't know.

T: Well, is there anything you could do on the paper that would help you know for sure?

S: Because it says "in all."

T: Oh, so you think maybe you should add. Well, what do you think you should do? Go ahead and just show me.

(writes down a column of seven 12s)

T: It looks like you wrote down 12...how many times?

S: Seven.

T: How come?

S: Because there's 7 boxes and in each box there's 12 crayons.

T: Oh, so there's 12 crayons in each of the 7 boxes so is that why you wrote 12 seven times?

S: Yeah.

T: OK, and then what are you going to do?

S: Add them.

T: OK, sounds good.  
(adds the numbers)

T: And what is the answer?

S: She bought 84 boxes of crayons.

T: 84 boxes of crayons?

S: Yeah.

T: Really?

S: No, she bought 84 crayons.

T: How do you know that? How do you know it's crayons instead of boxes?

S: Because it says here "How many crayons did Maria buy in all?"

T: Uh huh. So your answer...your label would be...

S: 84 crayons.

T: OK, sounds good.

#### **Student 4**

(reads the problem)

T: So, what do you think you should do to solve the problem?

S: Make 7 boxes.

T: OK, go for it.

(draws boxes)

T: OK, so it looks like you're drawing 7 boxes.

S: And then I put 12 crayons in each box.

T: Alright, perfect.

(draws crayons)

T: OK, so it looks like you've got 12 in each box. Now what?

S: I'm gonna count them.

T: So, what is going on in your head?

S: I'm gonna add them... 12 plus 12 plus 12...

T: Wow, so are you going to add all those 12s all in a row at one time?

S: I'm gonna add a few at a time.

T: Yeah, show me.

(student writes  $12 + 12$ )

T: So, you've got  $12 + 12$ . How much is that?

S: 24. And then  $12 + 12$  is another 24.  $12 + 12 + 12$  is 36.

T: Can you tell me how you did the adding there? I see on your paper  $24 + 24 + 36$ . But, what was your first step?

S: I plussed 4 plus 4 plus 6 and that's 14. And then I put the 1 over here and then I plussed 2 plus 2 plus 3 plus 1 and that's 8.

T: OK, good. Then what?

S: Then I got 84.

T: OK, 84. And do you have to do another step to finish the problem?

S: Next, I have to label.

T: OK. So what's your label?

S: Crayons.

T: OK, so is that your answer, 84 crayons?

S: Yes.

T: That looks beautiful and you got it right.

### **Student 5**

(reads the problem)

S: The first thing I did was read the story. The second step is I'm gonna find the question that they're asking me for.

T: Alright.

S: And I'm gonna underline it.

T: Yeah, do whatever you want and write whatever you want to show how to solve it.

S: So, if it's asking me how many crayons did Mary buy in all, I have to multiply 12 times 7.

T: How did you know that?

S: Because it says that she bought 7 boxes and 12 crayons in each box, so that's multiply. So, 12 times 7 equals...

T: So, it looks like you made some boxes there. What's that about?

S: I'm doing partial products.

T: Perfect!

(works out the problem)

S: It's 84 crayons.

T: How did you know it was crayons?

S: Because it says how many crayons.

T: You're right, and that's the right answer. Perfect.

**Student 6**

(reads the problem)

T: So, what do you think? How are you going to solve it?

S: Multiply them?

T: OK, why do you think multiply?

S: Um, no, divide.

T: How come?

S: Because it said she bought 7 boxes and each box has 12 crayons.

T: OK, is there anything you could do on the paper to help you to see what is happening in the problem? What could you do?

S: Draw 7 boxes and each box has 12 crayons.

T: OK, let's see it.

(draws picture)

T: OK, it looks like you've got your 7 boxes with 12 tally marks in each box to show the 12 crayons. Now what?

S: Now I have to count the crayons.

T: OK, let's see it.

S: 84.

T: OK, so you counted each crayon and you found there was a total of 84?

S: Yes.

T: So, then what?

S: Then I put that I divided.

T: Is that what you did? You divided? You're right she bought 84 crayons and you can see that in your picture. But did you divide numbers? Did you take a big number and divide it into smaller groups?

S: No.

T: What did you do?

S: Multiply.

T: You did. You multiplied. You've got 7 boxes, and that's like 7 groups. And there are 12 in each group. So, 7 groups of 12 is the same as 7 times 12. And really, you can think about the problem as multiplication, or you can think about it like you just did it. You were adding. You added all of these numbers together. So really, you could say that it's an addition problem. It's repeated addition. You are repeatedly adding  $12 + 12 + 12 \dots$  (etc.) and then you get your answer of 84. Either way, if you're multiplying 7 groups of 12 or adding  $12 + 12 + 12 \dots$  (etc.) you get the same answer.

Can you write the answer down?

(writes 84)

T: And what would your label be? 84 what?

(writes crayons)

T: Good, so your answer is 84...

S: Crayons.

T: Good.

## APPENDIX E

Parent consent letter – English

January 3, 2010

Dear Parent or Guardian,

I am working on my Master's in ESL (English as a Second Language) degree at Hamline University. To complete my degree, I need to do research in your child's classroom. I will study how your child solves math word problems. I have permission from North Park and Hamline University to do this study. However, I also need to ask for your permission to have your child participate in my study.

I already work with your child every day, teaching math and reading. Very soon, we will be focusing on solving math word problems and will even be writing some of our own math word problems. My study is designed to see how this teaching will help your child get better at solving math word problems. I will write a report about what I learn and it will be published and used to help other teachers. Your child will still learn about solving math word problems in class, even if I don't include him/her in my report. Your child will not lose any learning time during this research study.

I will not use your child's name in my report or identify them in any way. All the information I collect about your child will be confidential. If you don't want your child to be included in my report, that is OK. Also, your child can stop participating in the study at any time if you wish.

If you have questions, please contact me at [langenej@colheights.k12.mn.us](mailto:langenej@colheights.k12.mn.us) (763-528-4298) or Ann Mabbott at Hamline University at [amabbott@hamline.edu](mailto:amabbott@hamline.edu) (651-523-2446).

Thank you,

Jennifer Langeness  
ELL Teacher, 4<sup>th</sup> Grade  
North Park Elementary School

**If you give permission for your child to be a part of this research study, please sign both letters. Return one letter to me and keep the other letter.**

**My Child's Name** \_\_\_\_\_

**My Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

APPENDIX F

Parent consent letter – Spanish

03 de enero 2010

Estimado padre o tutor,

Estoy trabajando en mi Maestría en ESL (Inglés como Segundo Idioma) en la Universidad Hamline. Para completar mis estudios, tengo que hacer la investigación en el salón de su hijo. Voy a estudiar cómo los niños resuelven problemas matemáticos. Tengo permiso de la escuela North Park y la Universidad de Hamline para hacer este estudio. Sin embargo, también necesito pedir su permiso para que su hijo participe en mi estudio.

Ya estoy trabajando con su hijo todos los días, en las áreas de matemáticas y lectura. Muy pronto, nos enfocaremos en la solución de problemas matemáticos, e incluso vamos a crear nuestros propios problemas de este tipo. Mi estudio está diseñado para ver cómo ayudar a su hijo a mejorar en la resolución de problemas matemáticos. Voy a escribir un informe que se publicará y se utilizará para ayudar a otros maestros. Su hijo todavía aprenderá acerca de la solución de estos problemas en la clase, incluso si yo no lo incluyo su hijo en mi reporte. Su hijo no perderá el tiempo de aprendizaje durante este estudio de investigación.

No voy a usar el nombre de su hijo en mi informe o identificarlo. Toda la información que recopilamos sobre su hijo será confidencial. Si no quieres que su hijo sea incluido en mi informe, no hay problema. Además, su hijo puede dejar de participar en el estudio en cualquier momento si lo desea.

Si tiene preguntas, por favor comuníquese conmigo al [langenej@colheights.k12.mn.us](mailto:langenej@colheights.k12.mn.us) (763-528-4298) o Ann Mabbott en la Universidad Hamline en [amabbott@hamline.edu](mailto:amabbott@hamline.edu) (651-523-2446).

Gracias,

Jennifer Langeness  
ESL Maestra, 4<sup>o</sup> Grado  
North Park Elementary School

**Si usted le da autorización a su hijo a ser parte de este estudio de investigación, por favor, firme ambas cartas. Regresar una carta dirigida a mí y mantener la otra carta para ustedes.**

Nombre del Niño/a \_\_\_\_\_

Firma: \_\_\_\_\_

Fecha: \_\_\_\_\_

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