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A Content Analysis of Addition and Subtraction from the Math Teacher's Manuals for Orono, Maine and Santiago, Chile

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A CONTENT ANALYSIS OF ADDITION AND SUBTRACTION FROM THE MATH TEACHER'S MANUALS FOR ORONO, MAINE AND SANTIAGO, CHILE

by

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ABSTRACT

The purpose of this study is to do a comparative content analysis of two second grade math teachers' manuals; one from Santiago, Chile and the other from Orono, Maine. I will be looking at and comparing one unit of study in both math teacher's manuals: a unit on addition and subtraction.

This thesis will explore how the words and language used in the math teacher's manuals may affect the way teachers teach addition and subtraction content and what is expected from the second-grade learners. For the comparative content analysis I will focus on, sort, and count the verbs that appear in the math teacher's manual in one addition and subtraction unit of study. I will sort the verbs collected using the revised version of Bloom's Taxonomy. After organizing this data, I will compare the two math teacher's manuals based on the percentages and number of different verbs for each level of Bloom's Taxonomy.

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CHAPTER 1: INTRODUCTION

Addition and subtraction are the basic operations of mathematics. Studies have shown that students' performance in these basic operations can directly predict their future success in mathematics (Casey, McPherran Lombardi, Pollock, Fineman, Pezaris, 2017). The significance of these skills does not change between language or culture. In both Santiago, Chile and Orono, Maine, standards regulate what students in second grade must learn in regard to addition and subtraction.

After studying Spanish for many years, I have always been interested in how things are explained differently based on different languages and cultures. This sparked my interest in the effect language had on education both for the learner and the teacher. When I was teaching English in Mexico, I had the opportunity to observe a math class at a local school. This class was run very differently from any math class I had ever seen as a student or teacher of math. The class in Mexico was much more community-oriented than classes I had observed in the United States and the Mexican students were working independently from the teacher, but in groups supporting each other.

After observing this, I decided I wanted to do some type of research comparing the teaching of math in a Spanish-speaking country and the United States. Math was the most concrete topic, which was why I chose it. No matter what language you speak, one plus one is two and five times five is 25. Other subjects, like literature or social studies, would have different content depending on the location they were taught.

When I was abroad in Chile, I had the opportunity to take a class on Latin American Culture, which had a brief unit on education. Learning about the education system in Latin America solidified my choice to do some type of comparative study,

focusing on a single component of the two educational systems. I was able to access the standards used to guide instruction in Chile and noticed that addition and subtraction were topics that were required to be taught in second grade in both countries per the standards. This was what made me choose to analyze the parts of the math teacher's manuals that were focused on teaching addition and subtraction.

Based on logistical concerns, a content analysis was the most reasonable way to analyze the texts. The math teacher's manuals held all the directions that the teachers were given to inform their instruction of addition and subtraction. In addition, for each lesson detailed in the math teacher's manual, there was a pictorial representation of the corresponding workbook page that students would be required to do. This made the math teacher's manuals more effective to analyze over any of the other texts associated with the instruction of addition and subtraction.

When I started to look at the math teacher's manuals, I wanted to find something that would be comparable. I noticed that they used very different manipulatives, but more interestingly, the verbs they used seemed very different. As I read more, I became more interested in the verbs selected to inform the math teacher's instruction and decided to collect verbs from the two books to analyze the language used to inform the math teacher's instruction of addition and subtraction. As this project progressed I decided to sort the verbs I found into the levels of Bloom's Taxonomy based on the level of thinking the verb dictated. In education, Bloom's Taxonomy is often used to analyze instruction to see the distribution between the different levels of questions being asked (Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrick, 2001). This is what I did with the verbs from the two math teacher's manuals for the chapters on addition and subtraction.

Research question:

The purpose of this research is to determine how the verbs used to inform the teacher's instruction of addition and subtraction in math teacher's manuals from Santiago, Chile and Orono, Maine compare when sorted into the levels of Bloom's Taxonomy. Through my research I will answer the following:

1. What are the verbs used to inform the teacher's instruction of addition and subtraction in the two chapters from the math teacher's manuals from Santiago, Chile and Orono, Maine?
2. How do the number of different verbs used to inform teacher's instruction of addition and subtraction in the two chapters from the math teacher's manuals from Santiago, Chile and Orono, Maine compare?
3. How do the verbs used to inform teacher's instruction of addition and subtraction in the two chapters from the math teacher's manuals from Santiago, Chile and Orono, Maine compare when categorized into the levels of Blooms' taxonomy?

CHAPTER 2: LITERATURE REVIEW

Content Analysis

Content analysis was first documented in eighteenth-century Sweden, when there were accusations that a collection of hymns had too many religious symbols. Scholars and the clergy disagreed about the number of religious symbols and decided to count how many times the religious symbols showed up in the hymn books (Krippendorff, 1980).

Prior to gaining popularity in academia, content analysis was used to compare different newspapers and the content they were covering, as well as various forms of propaganda. It was after World War II that content analysis spread to different disciplines and information on the methodology and applications of this type of analysis were published. It was around this time that computers were also used to assist in the content analysis of texts.

One definition of content analysis (Downe-Wamboldt, 1992) is, "a research method that provides a systematic and objective means to make valid inferences from verbal, visual, or written data in order to describe and quantify specific phenomena" (p. 314). This definition takes into account the objective and systematic notions that Berelson identified as key components of the method as well as the concept of quantifying specific phenomena.

While Downe-Wamboldt and Berelson identify what content analysis is, Krippendorff (1969) identifies what content analysis is not. In the introduction to *The Analysis of Communication Content*, Krippendorff points out that content analysis is based on what the text says, not what it implies. Krippendorff (1969) says, "Content analysts are rarely interested in what messages are intended to mean" (p. 5). This is key

in the analysis of my texts because I am interested in evaluating the specific words that the math teacher's manuals use.

In the case of my thesis, I will be using math teacher's manuals as my written data in order to understand the phenomena of the impact that language has on the instructional methods of second grade addition and subtraction in Santiago, Chile and Orono, Maine. I will be using the methodology by finding the verbs that appear in the texts that inform the teacher's instruction of addition and subtraction. Then I will tally and count the verbs to find the total number of different verbs used to inform the teacher's instruction. These verbs will then be sorted into a level of Bloom's Taxonomy based on three rules I have made. I will first consult the definitions from Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths, and Wittrock's text. Next, I will refer to the chart that has mathematical terms sorted into Bloom's Taxonomy from Early Learning Matters (Early Learning Matters). Finally, I will refer to my previous schema from courses I have taken in the education department where we learned about the levels of Bloom's Taxonomy and how to apply this knowledge to each word I sort.

The type of content analysis that will be used in this project, also referred to as classic content analysis, has four key characteristics, as identified by Bernard Berelson. These characteristics include: 1) the application "to the syntactic and semantic dimensions of language," 2) the research must be "objective," 3) the research must be "systematic," and 4) the research must be quantitative (Berelson 1971). These four components of the research are what allow the research to keep its validity and reliability and will be explained more in depth later.

Although there is no prescribed set of procedures tied with content analysis, Downe-Wamboldt (1992) suggests one that starts with "1) selecting the unit of analysis, 2) creating and defining the categories, 3) pretesting the category definitions and rules, 4) assessing reliability and validity, 5) revising the coding rules if necessary, 6) pretesting the revised category scheme, 7) coding all the data, and 8) reassessing reliability and validity" (p. 315). For my content analysis, this general framework will work well.

First, I will select the unit of analysis. I have decided that I will start with one chapter from the *Guía Didáctica del Docente* from Santiago, Chile and one chapter from the teacher's manual of Everyday Mathematics borrowed from a teacher teaching at Asa Adams School in Orono, Maine. Both of these chapters are focused on informing the teaching of addition and subtraction to second grade students. The unit of analysis will be the verbs that inform the teacher's instruction of addition and subtraction.

Second, Downe-Wamboldt suggests that you create and define the categories. The categories I will use are the levels of Bloom's Taxonomy*: remember, understand, apply, analyze, evaluate,* and *create.* All the verbs collected will be placed into one of these categories.

The third step is to pretest the category definitions and rules. As the categories are predetermined by Bloom's Taxonomy, I will just be testing the rules I've created to be able to sort the verbs that inform the teacher's instruction into the different levels of the Taxonomy. The rules I determined for myself were: 1) consult the definitions from Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths, and Wittrock's text, 2) refer to the chart that has mathematical terms sorted into Bloom's Taxonomy from Early Learning Matters (Early Learning Matters) 3) refer to my previous schema from

courses I have taken in the education department where we learned about the levels of Bloom's Taxonomy and how this knowledge to each word I sort

To test my rules, I will use the first lesson in both of the math teacher's manuals. After sorting the verbs from the first chapters into the appropriate level of Bloom's Taxonomy, I will test to see if my rules for sorting are effective. For this step I will consult experts in the field to ensure that I am not missing anything.

The fourth step is to assess the reliability and validity. In terms of reliability and validity, there are many factors to consider to ensure that the analysis is done correctly. Reliability is how consistently the research is done, while validity is how well the research shows what it is intended to show (Price, 2015). Both are equally important to ensure the data is accurate and able to be used to show what I plan to show.

Karl Erik Rosengren (1981) cited Krippendorff's three types of reliability, which included first, stability; second, reproducibility; and third, accuracy as important to consider. In order to ensure this research is reliable, I will adhere to these three types of reliability. First, to produce stability, I will evaluate the texts objectively, consulting with experts when help is needed to translate specific words accurately. Second, I have identified that reproducibility is important so if someone did the same project, they would get the same results. This often becomes a problem when different people are doing the translation, which is not a factor in this project, so I cannot speak to the reproducibility of this research. I will meticulously document the steps that I use while doing this research in order to make it so that someone else could replicate the study if they wanted to and, by following the same steps, achieve the same results. Third, I will have identified accuracy, which determines that no matter what text the analysis is used on, the results

will be the same. Translation will play a role in the accuracy of this translation, which is why I am consulting with people who have a higher level of Spanish abilities than I do, to ensure that my translations are accurate. Translation as a whole will be discussed in a later section.

Along with stability, reproducibility, and accuracy, Rourke and Anderson (2004) published an article citing many problems that researchers who use Quantitative Content Analysis (QCA) run into when they are performing research and drawing conclusions based on the research. They found "the technique promising but chided researchers on the rigor of their reports, particularly on the lack of reliability data" (p. 5). They went on to elaborate on this idea, saying since then the people who review these data have become more focused on making sure the information is reliable. This is something I am going to work on, ensuring that all the data is obtained in a reliable manner. The three rules I made will also help with the reliability.

The second aspect to consider is the validity of the research. One of the major issues that has come up is the issue that the data do not always completely support the conclusions that researchers are making because the research is not done using a sufficient level of validity. Part of this comes from a poor research method, which is rectified in Rourke and Anderson's article by proposing an efficient five-step research method that is similar to the one that I will use proposed by Downe-Wamboldt (1992).

One method that Rourke and Anderson suggested to make the testing and measuring more valid was to remember the difference of a description versus an inference. With QCA, the information you collect can be descriptive, but if you want to make inferences they have to be based on the data collected. Rourke and Anderson

(2004) quote Messick (1989) saying, “Validity is an integrated evaluative judgment of the degree to which theoretical rationales and empirical evidence support the adequacy and appropriateness of interpretations and actions based on test scores or other methods of assessment (p.13)” (p. 6). In order to be made, inferences have to be supported by the information collected or they will not be valid. In order to ensure the reliability and validity of the results of the content analysis, it is important to avoid these mistakes that these experts have cited.

After noting the possible issues with reliability and validity, the fifth step proposed by Downe-Wamboldt is to revise the coding rules as needed, which could mean going back and recoding some or all of the data.

If the coding rules are changed, this means that step six, pretesting the revised categories, comes into play. I would have to use another section of the unit of analysis in order to determine that this new coding system will work efficiently. If it does not, I will go back and revise it again and again, until I have one that will definitely work and has been pretested, working well for the sample used.

Once the coding system is in place and functional, the seventh step is to code the data. This step will take the bulk of the time as it encompasses going through the addition and subtraction chapters in both the math teacher’s manuals and coding the verbs that inform the teacher’s instruction found in these chapters. This is also the part of the method that will produce the data I will be using and analyzing.

The final step of the entire process is to reassess the reliability and validity to ensure that the research was done in a reliable manner to produce valid results. In order to

do this effectively, I need to look at my initial concerns for reliability and validity and establish that these were met and no other issues came up throughout my research.

This completes the process of content analysis, but there are other details of the process to be cognizant of that could potentially affect the reliability, variability, and results of this research. Some of these are specific to the nature of the project, but also to the purpose of content analysis. One specific one related to this project is the aspect of translation. Since I will be coding words that I translate between Spanish and English, if something is translated incorrectly, it will affect my coding. The aspects of translation will be discussed in a later section.

According to Krippendorff (1980) the observers, "should, of course, be familiar with the nature of the material to be recorded but also capable of handling the categories and terms of the data language reliably" (p. 72). In order to analyze the content, I have to be familiar with the material from both of the math teacher's manuals as well as the categories and terms of the language of the data. I have studied mathematics and elementary education, so I have the qualifications to analyze the *Everyday Math* teacher's manual. Additionally, I studied Spanish and took a semester abroad in Chile, so I am familiar with the Chilean texts and language. I also have resources, including the professors in the Spanish department, *wordreference*, and Eliana Rojas from the University of Connecticut, to help if I get stuck with Spanish language. This qualifies me to analyze the *Mi Matemática* teacher's manual.

The uses of content analysis

Historically, content analysis was used to analyze communication content, but in recent years, there have been more varied uses of this method. Downe-Wamboldt (1992)

ended her article by saying, “Because of its focus on human communication, content analysis is particularly well suited to research involving the practice and education of nurses and other helping professions” (p. 320). Teaching is a helping profession, making it a perfect project on which to use content analysis.

Additionally, there has been research in related fields that has used content analysis. Some of these examples are research done comparing history books and standards in the United States, special education in Jordan and New South Wales, and postgraduate theses on special education. Nagai (2015) explores different projects using content analysis, specifically exploring *Molding the Good Citizen*, which looks at what type of views were expressed by textbooks between the 1940s and the1980s. This research allowed them to find, “The U.S. Standards speak of the American ‘peoples,’ not the American people. The word ‘mosaic’ is used, but the phrase ‘melting pot’ is not. ‘Diversity’ appears eight times; ‘liberty,’ zero” (Nagai, 2015, p. 477). This type of research is similar to the research that I will be using content analysis for, as I will also be seeing how many times specific verbs are used in both versions.

Sakarneh (2014) published a study comparing quality educational frameworks between New South Wales and Jordan. Content analysis was selected as the method due to the goal, “to explore the similarities and differences between the two frameworks in terms of their articulation of the concept of quality teaching to reach a conclusion of their understanding of quality teaching” (p. 8). In order to use content analysis the researchers first had to determine what quality teaching was and the common themes were tagged through content analysis. In the document from Jordan, there were twelve components of quality teaching found and in the New South Wales document there were 21 components

found. This is similar to the research that I will be doing, based on the educational nature of the texts as well as defining specific things to analyze and selecting words based on that. In this study the researchers were trying to define and recognize quality teaching, while in my project I will be trying to define and recognize language and word differences on Bloom's Taxonomy between the two math teacher's manuals.

Similar to the study done on quality teaching, content analysis was also used in a study conducted in Turkey that examined postgraduate theses written with a focus on special education, to determine what type of topics were commonly discussed. Although their topic was a little bit different, Demirok, Besgul, and Baglama (2016) used content analysis, with the goal of their study being, "to examine postgraduate thesis studies conducted between the years of 2009 and 2014 in special education field in Turkey based on various variables and figure out how many of these thesis are related with hearing disability" (p. 9). With this goal, the researchers took the 146 theses about special education and searched for key words such as ADHD, dyslexia, hearing disability, autism, learning disability and more, to evaluate what was the most studied topic within special education postgraduate theses. Once they collected the data, they were able to make conclusions based on that data. The way they used content analysis has many parallels to how I will use it in my thesis and shows that this can be an effective way of collecting data. In their case, they collected data on words related to special education, while mine will be looking at verbs that inform the teacher's instruction of addition and subtraction.

Although content analysis has been around for many years, within the past few decades the fields it is used in have been expanded, making it a reliable method to use for

my thesis on the differences and similarities in the distribution of verbs on Bloom's Taxonomy used to inform the teacher's instruction of second grade addition and subtraction in Chile and the U.S. through an analysis of two math teacher's manuals. In order to ensure that the data collected is accurate and reliable, I will use the resources and methods that other studies and the experts have used. I will be tallying the words used on each page and then totaling the number of words for each lesson and then for the entire chapter. With this data I plan to see how the specific language is different and similar in the two math teacher's manuals and make inferences about the math teacher's manual as a resource that teachers receive depending on their location and how the math teacher's manual informs the teacher's instruction of the second-grade math topic of addition and subtraction.

Translation

When translating texts, much of the interpretation of the translation is left up to the translator. There are many things that do not directly translate and it is up to the translator to determine the most efficient and correct way to translate those words or phrases. Because of this, every translator will have a slightly different translation. For my thesis, everything coming from the Chilean math teacher's manual, which is written in Spanish, has to be translated. In order to ensure the reliability of my thesis, it is important to recognize the most efficient methods to translate this material and some common errors to look out for while translating. In order to help with the accuracy of my translation, I will translate the words after the data is collected and sorted. I will write the

original word with the translated version in parentheses so it will be easier to check the translations when needed. In order to ensure that the translating I will do is the most effective, I will consider various aspects and implications of translation as well as the best way to maintain the integrity of the translation in my research.

Aspects and Implications of Translation

In translating, there is no set method that will work with every translation. It is an art as much as it is a science, with the translator having significant power in what the end result can be. In a translation like the one I am doing, it is important that it be as scientific and methodical as possible to help create stability, reproducibility, and accuracy.

Roman Jakobson, in his *On Linguistic Aspects of Translation*, discusses some of the factors of translation as well as the three different kinds of translation. He speaks of intralingual translating which is interpreting verbal signs of one language with other signs of the same language (rewording), interlingual translation which is "an interpretation of verbal signs by means of some other language," and finally intersemiotic translation, which is translating verbal signs to nonverbal signs or vice-versa (Jakobson, 1959, p. 145). In the work I am doing, I will be doing interlingual translations because I am taking words (verbal signs) from one language (Spanish) and translating them into another language.

When speaking of interlingual translation Jakobson warns that, "there is ordinarily no full equivalence between code-units, while messages may serve an adequate interpretations of alien code-units or messages" (Jakobson, 1959, p. 145). The example he gives is that there is no perfect translation of the English word 'cheese' into Russian

based on what each of these words include. This can occur in any two languages, which is why there will not always be a perfect translation for each word that appears in the math teacher's manual I am analyzing.

Another important aspect to look at is how the linguistic systems compare to each other. The grammar of a specific language can help to determine the aspects that are being expressed. Jakobson says, "It is more difficult to remain faithful to the original when we translate into a language provided with a certain grammatical category from a language devoid of such a category" (Jakobson, 1959, p.148). Luckily the grammatical systems between English and Spanish are similar in many ways, but there are still some things to consider. In Spanish, every verb has to be conjugated based on the tense and the person who is doing the action, while in English this is based on the words around the verb with minor changes in the verb itself. When collecting data, I will just be collecting the verbs that inform the teacher's instruction of addition and subtraction so this should not have a huge affect, but it is something to be mindful of.

Both the grammar and the lack of a perfect word-to-word translation will affect the translations that I perform. Since there is no perfect translation, many of the words I translate will require me to pick the translation that is the most relevant based on the context.

Translation is subjective by nature, but when it comes to translating things such as poems and songs, which have multiple layers of meaning, the differences of the translation can be seen much more clearly. In *Into English*, this process is shown with poems from all different languages being translated into English by three different translators. This shows that three different people can have three very different ways of

translating poetry. One example of this can be seen on page 100, where three translators — Clayton Eshleman (2007), Rebecca Seiferle (2003), and Barry Fogden (1995) — each translated the poem *Los heraldos negros* (The Black Heralds). Just looking at the first line, there is a disparity in the three versions. Both Eshleman and Seiferle translated it from "Hay golpes en la vida, tan fuertes… Yo no sé!" to "There are blows in life, so powerful…I don't know" while Fogden translated it to "You get knocks in life so vicious…It beats me!" (Collins and Prufer, 2017, p. 100-101). In this example, both versions have a very similar meaning, but there are other lines that are much different.

In the commentary following the translations Cindy Schuster speaks at great length about line five. Each translator translated this line differently. The original line was "Son pocos; pero son…Abren zanjas oscuras." Eshleman translated it to "They are few; but they are…They open dark trenches" while Seiferle translated it to "They're few; but they exist… they open dark furrows." Finally Fogden translated it to "Not many; but you get them…They open up dark sluices" (Collins and Prufer, 2017, p. 100-101). In the commentary that Schuster provides, she considers Eshleman's "They are few, but they are" to be a more literal translation, leaving the same uncertainty as in the original, while Seiferle and Fogden's versions show the failure of the language to express the existence of the blows, and Fogden adds the 'you', which makes it more conversational than the original (Collins and Prufer, 2017, p. 103). Schuster then looks further into the translation of the word "zanjas," which Seiferle translated to furrows and Eshleman translated to trenches, which according to Schuster are both literal translations (Collins and Prufer, 2017, p. 103). She doesn't speak of Fogden's version using "sluices."

This example of translation shows how subjective translation can be. Neither translation is more correct than the other ones; the translators just approached it differently, choosing various words based on their overall approach. With translation, the purpose of the translation can have an impact on the translation. When looking at the translation I am doing, if someone else were to translate the words that I translated, they may come up with a different translation based on the context and the purpose of their translation.

Carina del Valle Schorske wrote a letter of recommendation on translation for the *New York Times*. She spoke of the risks of translation and what can be lost with translation. She speaks both Spanish and English, so the translating she is speaking of is similar to the translating that I will do in my thesis. She says, "In every process of translation, there's always a word — or 10 — I don't really want to translate. Sometimes English swallows these words whole…" (Valle Schorske, 2017). She goes on to explain how sometimes she will just leave words in Spanish instead of translating them because the translation doesn't give the words the same meaning. Although this is possible for my thesis, I will translate everything that I can. If I come across something that I can't translate as perfectly as I would like, I will consider this approach. Since I am sorting them based on the level that I categorize them as on Bloom's Taxonomy, I can always leave words without translating them if needed.

Valle Schorske said, "If translation describes how something is understood in a context that marks it as foreign, then translation happens whether or not we intend to perform it. But when I translate literature — carefully, deliberately — I try to interrupt these ad hoc translations based on xenophobic logics, passing fancies and lazy

incuriosities" (Valle Schorske, 2017). She speaks of the possibility of changing the meaning of the words, whether this happens intentionally or not. This is something that I am going to try to avoid by consulting experts in the field in order to do the best translation that I can. I will keep in mind that there will still be changes in the meaning, but I will keep that in mind when analyzing the data. I am also keeping the words in Spanish with the English translation in parenthesis, so that people can see any inconsistencies in how I translated the words compared to how they would.

One more warning that Schorske gives is that, "Certain words stay stubborn on both sides of a border and don't seem to want to disclose themselves. I take that as a reminder that getting to know someone, and getting to know myself, is always an unfinished business" (Valle Schorske, 2017). When I translate the words from my text, there will be certain words that are more difficult to translate. I will do the best I can to translate them accurately, but for any ones that do not clearly "disclose" themselves, keeping the original language with the translation will allow people to see any inconsistencies. I will remember Valle Schorske's limitations of translation as I work on translating words from the Chilean teacher's manual.

Maintaining the integrity in research

Although *Conducting a Grounded Theory Study in a Language Other Than English: Procedures for Ensuring the Integrity of Translation* is mostly about grounded theory, which can be used for translating qualitative research as a whole, this text has information about the translation process that will be important to the translation I will be performing.

According to the text, "Forward translation is the process of translating data from the source language to the target language" (Nurjannah, 2014, p. 1). This means that I will be doing forward translation for my research as I will be translating the *Mi Matemática* teacher's manual from its language of Spanish to the target language of English, in which I will be doing the analysis. In the text, Nurjannah speaks about how backward translation can be used to verify the accuracy of the translation. This is a technique that I can use if I want to check a translation.

In *Conducting a Grounded Theory Study in a Language Other than English: Procedures for Ensuring the Integrity of Translation*, the authors also speak of rigor and the potential problems. They say, "The issue of rigor in data analysis becomes a greater concern when the results of the study are published in a language other than the one used to obtain the data" (Nurjannah, 2014, p. 2). This will not become an issue since the language that I am using to obtain the data, English, will be the same language that I will be publishing the study. The data that I am collecting in Spanish will be translated into English so that all the data collected will be in English. It makes it so that there is only one translation instead of two different translations where meaning could be lost.

One final take-away from the text is that "issues related to the translation process need to be addressed prior to data collection and analysis because there is potential for meaning and intent of the research to be lost if the process of translation is not appropriate" (Nurjannah, 2014, p. 2). In order to avoid this problem, I recognized the potential problems with translating prior to translating my data. I also made certain that my translating process was effective before analyzing my data. Since I collected the data in Spanish before translating it to English, this helped to give me more time to determine

an effective process for translating the collected data from English to Spanish. Even once I collected the data, I left the Spanish word with the translated word so as to ensure that they are both available to identify any errors in translation quickly.

There are many different approaches to translation, each of which offers important aspects that I will use in my work. In his book *English-Spanish Translation, Through a Cross-Cultural Interpretation Approach,* Francisco Castro-Paniagua talks about some of the different methods and the important components.

According to Castro-Paniagua, one important aspect of translation is objectivity. Castro-Paniagua says, "Objectivity in translation might prove to be as difficult to achieve as being committed to a political position as a writer" (Castro-Paniagua, 2000, p. 53). He talks about how all translators have a specific style, which at times may include a political position, but it is important for translators to stay uncommitted. "Being uncommitted in translation then, would mean to recognize and accept not just other cultural shortcomings but also our own" (Castro-Paniagua, 2000, p. 53). As a translator, being uncommitted is essential in order to stay objective. Since the data I'm collecting does not have political implications, it should be easier to maintain objectivity, but it is still important to be cognizant of this potential problem.

Although there are many theories, Castro-Paniagua talks about Wolfram Wilss' thoughts on the importance of not selecting one methodology. He says, "unlike other disciplines which are more systematic like grammar, semantics, etc., translation can not be reduced to an exact methodology" (Castro-Paniagua, 2000, p. 59). Although translation is sometimes considered a science, there isn't an exact methodology to translation, which requires the translator to use what is appropriate based on the

circumstances. It is important to consider the type of text you are translating and decide what method is the best to use for that specific translation.

Mildred Larson has three characteristics that Castro-Paniagua writes about in his text. These three characteristics are: the text uses the natural language as its original code, the text should have the same meaning as the source language, and the text should have the same dynamics as the original (Castro-Paniagua, 2000, p. 65). Since the text I am translating only has a surface meaning, it will make it simpler to translate and I will know that it has the same meaning as the source language since there isn't another significant layer of meaning. This is explained more in depth further along in the book when Castro-Paniagua adds more details to what Larson has said: "Larson says there are two types of information in a text, implicit and explicit. Explicit translation is stated directly in a text, and implicit translation is not stated but is shared by reader and writer" (Castro-Paniagua 66). I am only translating explicitly, which means that is the only information I am looking at. Based on the information that Castro-Paniagua shares, I will be using a variety of methods to translate the Chilean teacher's manual to help me to stay objective.

Although there is no set way to best translate, I will consider the type of research I am doing when translating as well as the context of the language. Since my research is based on the surface value of the words, this will save me some potential problems in my translation, but I still will need to be aware of the possible translations, and when necessary consult an expert in the field.

Bloom's Taxonomy

Bloom's Taxonomy is a six-level taxonomy that can be used to classify words and the level of thinking they require. This has been shaped into a pyramid, which is commonly used in education to determine the level of thinking students are being asked to do based on the word choice of the prompt or question. There was an original taxonomy created, which went through a revision that changed some of the levels within the taxonomy. As an education student, we learned about Bloom's Taxonomy and the various levels in our education classes so that we could be conscious of the level of thinking we were asking our students to perform whenever we asked them a question. In my research, I will be using Bloom's Taxonomy as a method of analyzing the verbs that inform the teacher's instruction of addition and subtraction in the math teacher's manuals from Santiago, Chile and Orono, Maine. I will categorize the verbs I collect into a level of Bloom's Taxonomy based on what they prompt a student to do.

History of Bloom's Taxonomy in Education

According to the *Taxonomy of Educational Objectives*, Bloom's Taxonomy was first created by college examiners at an informal meeting during the American Psychological Association Convention in Boston, Massachusetts in 1948. These examiners wanted an intellectual framework that could assist in effective communication between examiners to help with the exchanging of test materials and information on testing. They also thought it would help to examine the relationships between testing and education. This relationship connects Bloom's Taxonomy to my research in education (Engelhart, Furst, Hill, Krathwohl, 1956).

The New Taxonomy of Educational Objectives (2007) gives a summary of the original version of Bloom's Taxonomy. The original version started with knowledge, then comprehension, application, analysis, synthesis, and finally evaluation. This was the only element of categorizing based on the words and there was one dimension of categorizing (Marzano and Kendall, p. 5). This version can be seen in figure 1.

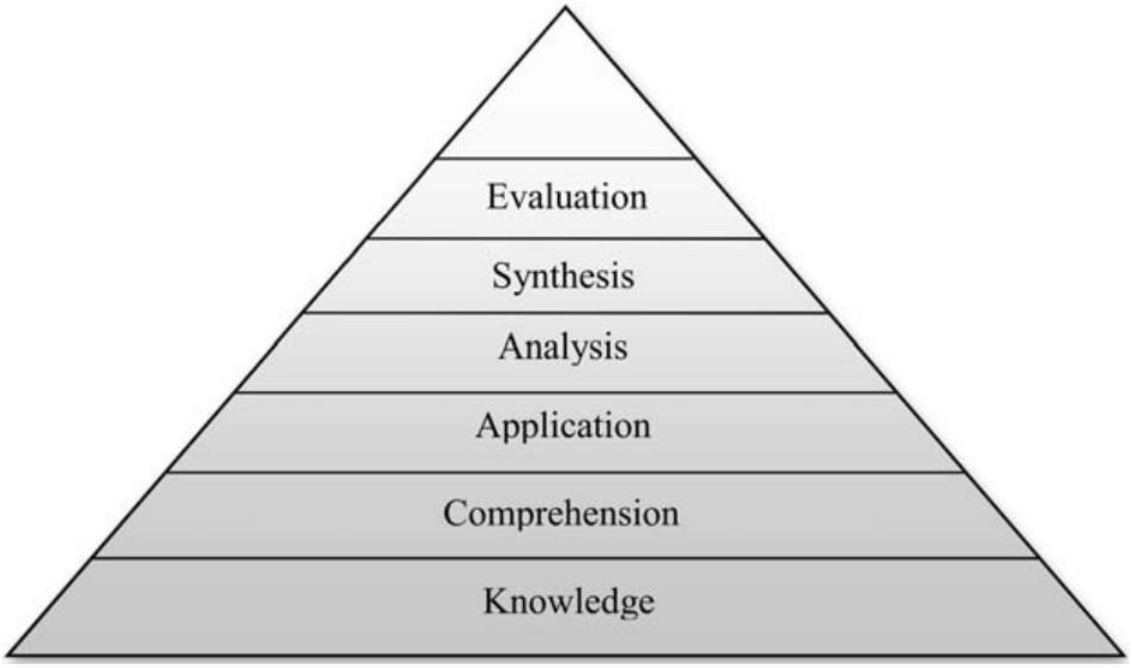


Figure 1. Original version of Bloom's Taxonomy (Darwazeh, 2017, p. 15).

Lorin Anderson, who studied under Bloom, worked with David Krathwohl to revise Bloom's Taxonomy to the version we use now. According to *A New Revision of the [Revised] Bloom's Taxonomy*, Krathwohl and Anderson revised it based on a review of literature on cognitive and metacognitive psychology studies, looking at research on intellectual skills, human thinking and learning, and human information processing (Darwazeh, 2017, p. 15). They came up with nine conclusions that create the new version

of Bloom's Taxonomy, which is used today, and will be used for my research. To see the differences, see figure 2.

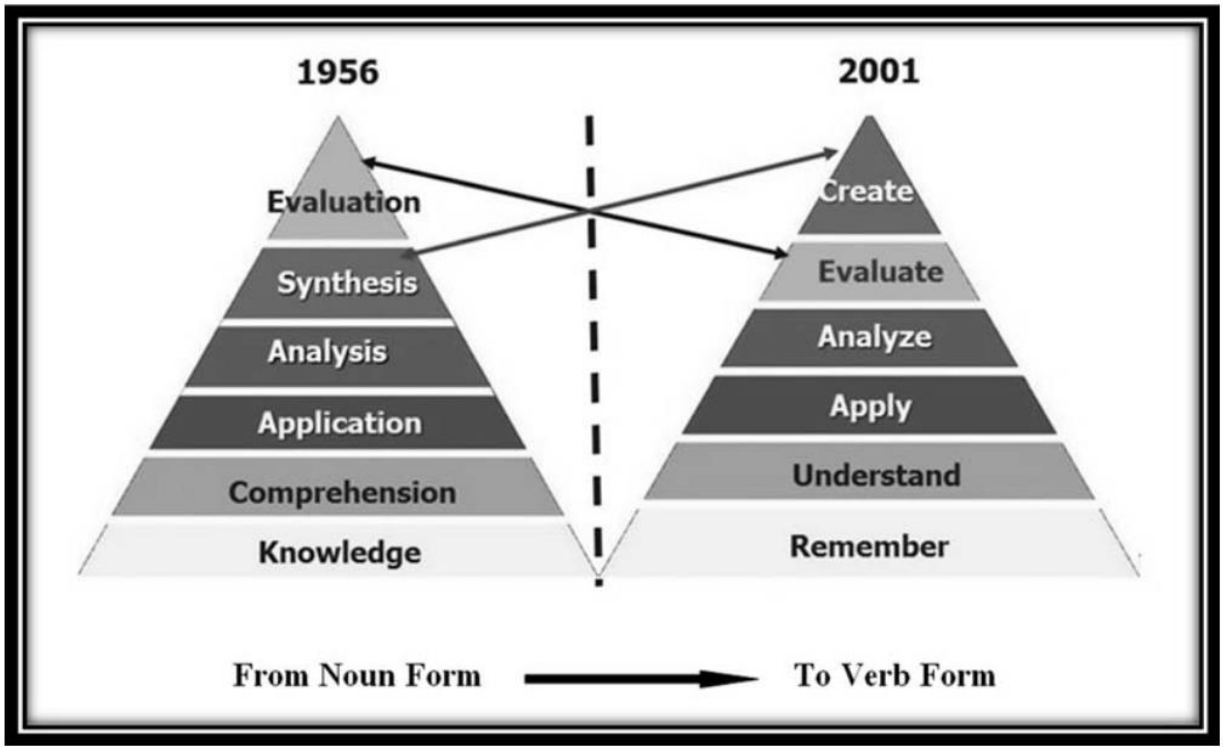


Figure 2. Comparison of the two versions of Bloom's Taxonomy (Darwazeh, 2017, p. 16).

In *A Taxonomy for Learning, Teaching, and Assessing* (2001), the new version of Bloom's Taxonomy is discussed. This new version still has six levels, but it has an additional component of knowledge dimensions within each of these levels. Some of the original six levels have been renamed and the six of them are now collectively known as the cognitive process dimensions. These are now known as *remember*, *understand*, *apply*, *analyze*, *evaluate*, and *create*.

Levels of Bloom's Taxonomy

Level one is *remember*. *Remember* means to "retrieve relevant knowledge from long-term memory" and can include recognizing and recalling (Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths, and Wittrock, p. 31).

Level two is *understand*. *Understand* means to "construct meaning from instructional messages, including oral, written, and graphic communication" and can include interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining (Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths, and Wittrock, p. 31).

Level three is *apply*. *Apply* means to "carry out or use a procedure in a given situation," and can include executing and implementing (Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths, and Wittrock, p. 31).

Level four is *analyze*. *Analyze* means to "break material into constituent parts and determine how parts relate to one another and to an overall structure or purpose" including differentiating, organizing, and attributing (Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths, and Wittrock, p. 31).

Level five is *evaluate*. *Evaluate* means to "make judgments based on criteria and standards" which includes checking and critiquing (Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths, and Wittrock, p. 31).

The top level, level six is *create*. *Create* means to "put elements together to form a coherent or functional whole; reorganize elements into a new pattern or structure" including generating, planning, and producing (Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths, and Wittrock, p. 31). These six levels will be the ones I will use to sort the verbs from the two math teacher's manuals.

According to *A New Method for Assessing Critical Thinking in the Classroom*, the levels of Bloom's Taxonomy are divided into higher-order and lower-order thinking skills. The first three categories: knowledge, comprehension, and application are the

lower-order skills because they are the base of knowledge, which don't require higher level thinking skills such as problem solving or critical thinking. Analysis, synthesis, and evaluation are the higher-order thinking skills (Bissell and Lemons, 2006). These higher-order thinking skills do require problem solving and critical thinking. The learning that happens in the lower levels enables the building of skills in the higher levels of the taxonomy. I will be using the higher-order and lower-order differentiation in my research to further compare the data I collect. This is similar to what Bissell and Lemons did in their research.

Uses of Bloom's Taxonomy in Education

According to the 1956 book *Taxonomy of Educational Objectives,* Bloom's Taxonomy has many uses. It says, "The use of the taxonomy as an aid in developing a precise definition and classification of such vaguely defined terms as 'thinking' and 'problem solving' would enable a group of schools to discern the similarities and differences among the goals of their different instructional programs" (Engelhart, Furst, Hill, Krathwohl, p. 10). The taxonomy allows words that are asking similar level skills to be classified so that even if different words are used, various programs can be compared more easily.

This text also discusses that any taxonomy is set up so that there are symbols, which have definitions to allow a group of people to come to agreement on what would fit into this category (Engelhart, Furst, Hill, Krathwohl, 1956). This means that each category contains words, which all have the same components, allowing me to put the

verbs in the math teacher's manuals I am analyzing into the levels of Bloom's Taxonomy based on their definitions.

The 1956 text, *Taxonomy of Educational Objectives*, says, "Although the taxonomy is not too useful in classifying such broadly stated outcomes of learning, it is useful in helping to determine the level of specificity at which statements of objectives can be utilized in planning learning experiences and suggests types of evaluation evidence which might be appropriate" (Engelhart, Furst, Hill, Krathwohl, p. 47). Since the math teacher's manuals I am analyzing are not broad outcomes of learning, but instead statements to help inform classroom teachers as they plan learning experiences about addition and subtraction, Bloom's Taxonomy will be useful to classify the verbs used in the math teacher's manuals.

Similar Research using Bloom's Taxonomy

When speaking about Bloom's Taxonomy, *Rethinking Trends in Instructional Objectives: Exploring the Alignment of Objectives with Activities and Assessment in Higher Education— A Case Study*, says that Bloom's Taxonomy "was intended to classify goals in the education system and offer a platform upon which educators could openly discuss and exchange ideas about curriculum development" (Yamanaka and Wu, 2014, p. 76). In this project, the researchers used the Taxonomy in a way similar to the way that I will be using the six levels of the taxonomy. The researchers analyzed syllabi from undergraduate and graduate level courses at a Midwest higher education institute in the United States. They looked at the learning outcomes, while I will be looking at the

verbs used in the math teacher's manual. Their method of using these six levels of the taxonomy is very similar to what I will do.

In *A Descriptive Content Analysis of the Extent of Bloom's Taxonomy in the Reading Comprehension Questions of the Course Book Q: Skills for Success 4 Reading and Writing*, Ulum says that "Bloom's Taxonomy is probably the most commonly used one among the cognitive process models" (Ulum, 2016, p. 1674). This is the reason the researchers in this study used Bloom's Taxonomy, and also the reason I will use it. This study worked to find the extent to which Bloom's Taxonomy was referred to in the reading comprehension questions of an English as a Foreign Language course book. Although this research is only looking at one textbook and I am looking at two math teacher's manuals, the use of Bloom's Taxonomy is similar. They also use the same taxonomy that I will use for my research. In this study, the researchers looked at the reading comprehension questions, while I am looking at the verbs used in the math teacher's manuals to inform the teacher's instruction of addition and subtraction. Both of us chose to use the percentages and frequencies for each level. Additionally, they chose to use a table to represent their data and I also plan to present my data in tables and other visual representations.

Bloom's Taxonomy has commonly been used to classify levels of thinking and was created to be used in educational research. I will be using the newer version of Bloom's Taxonomy. This revised version has been previously used in research that I cited as a method to compare the syllabi from various classes as well as the type of reading comprehension questions used in a text. Both of these are similar to the

methodology I will be using. I will also be using the levels of higher- and lower-level skills to further compare the math teacher's manuals.

CHAPTER 3: METHODS

Teacher Manuals

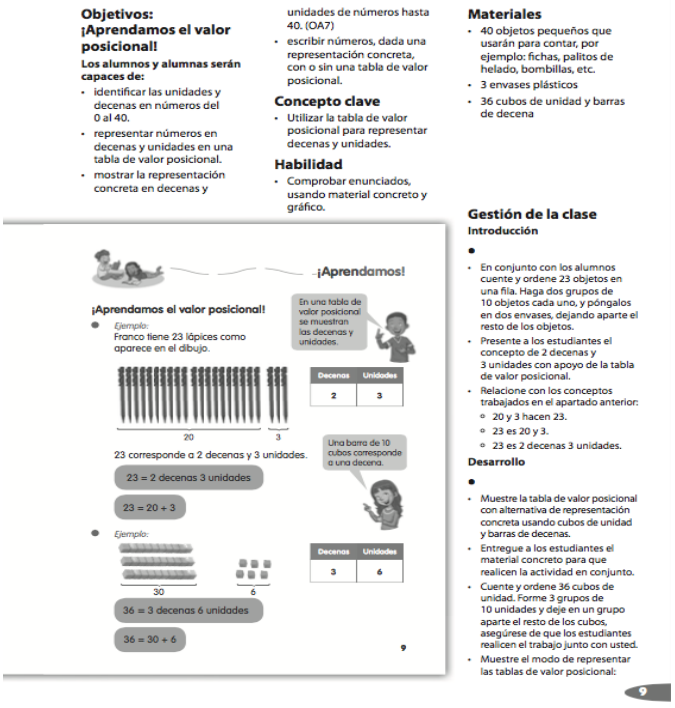
For this project I identified two second grade teacher manuals, one used in Santiago, Chile and one used in Orono, Maine. The math teacher's manual from Santiago, Chile was the *Guía Didáctica del Docente*, or the teacher's manual from *Mi Matemática*. The teacher's manual from Orono, Maine was *Everyday Mathematics*. I obtained the *Guía Didáctica del Docente* from the director during my study abroad program. It was in the form of an online drive that contains all the textbooks for every subject that the Chilean education system uses. I borrowed the math teacher's manual of *Everyday Mathematics* from a teacher who works at Asa Adams School in Orono, Maine. The texts I analyzed are the math teacher's manuals used by classroom teachers to inform their math instructional practices in their classrooms.

The teacher manual, *Guía Didáctica del Docente*, has twelve capítulos (chapters), which are broken into smaller lessons. Each lesson starts with a chart that explains the chapter and the horas pedagógicas (pedagogical hours), objetivos (objectives), recursos (resources), and habilidades (skills) for each lesson within the chapter. After this, it goes through each lesson within the chapter. Finally the chapter ends with un banco de preguntas (a bank of questions), which are options for support and extension. Each chapter has the same format.

The teacher manual from *Everyday Mathematics* has nine units, which are then broken down into smaller lessons, which are typically intended for one day of instruction. Each unit starts with an organizer that goes through the breakdown of the Common Core standards, which are the standards that the United States uses to guide their education.

The next part is a unit overview that includes the materials needed for each lesson and what pages are used. Then each unit gives a background on the strategies and vocabulary important to that chapter. After this each lesson is detailed, including the lessons, which involve the assessment.

In *Guía Didáctica del Docente* the lessons are very fluid within a chapter. The only clear way to know that a new lesson is starting is the word objetivos (objectives), which is at the start of each lesson. After this, there is the overview for instruction, including the concepto clave (key concept) and the materiales (materials). In the center of each teacher page, there are pictures of the student textbook (see figure 3). After explaining the overview of the lesson the book goes into more detail about ways to teach including various activities. The activities vary based on the objectives.



Objetivos:
¡Aprendamos el valor posicional!

Los alumnos y alumnas serán capaces de:

- identificar las unidades y decenas en números del 0 al 40.
- representar números en decenas y unidades en una tabla de valor posicional.
- mostrar la representación concreta en decenas y unidades de números hasta 40. (OA7)
- escribir números, dada una representación concreta, con o sin una tabla de valor posicional.

Concepto clave

- Utilizar la tabla de valor posicional para representar decenas y unidades.

Habilidad

- Comprobar enunciados, usando material concreto y gráfico.

Materiales

- 40 objetos pequeños que usarán para contar, por ejemplo: fichas, palitos de helado, bombillas, etc.
- 3 envases plásticos
- 36 cubos de unidad y barras de decena

¡Aprendamos!

¡Aprendamos el valor posicional!

Ejemplo:
Franco tiene 23 lápices como aparece en el dibujo.

En una tabla de valor posicional se muestran las decenas y unidades.

Decenas	Unidades
2	3

20 3

23 corresponde a 2 decenas y 3 unidades.

Una barra de 10 cubos corresponde a una decena.

23 = 2 decenas 3 unidades

23 = 20 + 3

Ejemplo:

Decenas	Unidades
3	6

30 6

36 = 3 decenas 6 unidades

36 = 30 + 6

9

Gestión de la clase

Introducción

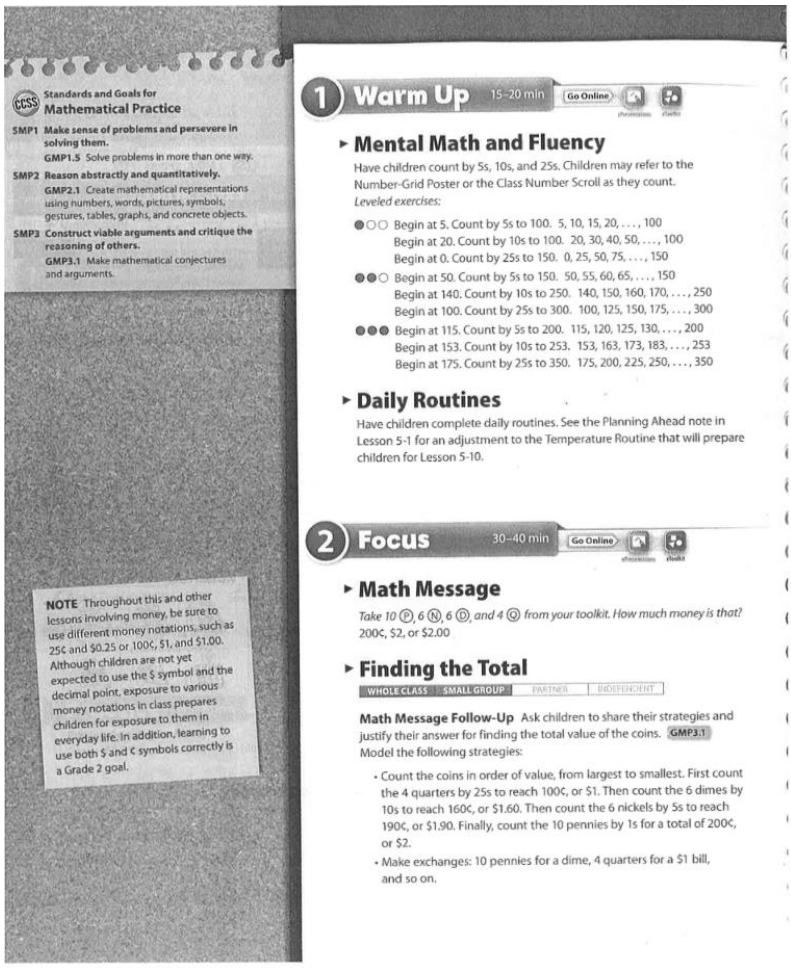
- En conjunto con los alumnos cuente y ordene 23 objetos en una fila. Haga dos grupos de 10 objetos cada uno, y póngalos en dos envases, dejando aparte el resto de los objetos.
- Presente a los estudiantes el concepto de 2 decenas y 3 unidades con apoyo de la tabla de valor posicional.
- Relacione con los conceptos trabajados en el apartado anterior:
  - 20 y 3 hacen 23.
  - 23 es 20 y 3.
  - 23 es 2 decenas 3 unidades.

Desarrollo

- Muestre la tabla de valor posicional con alternativa de representación concreta usando cubos de unidad y barras de decenas.
- Entregue a los estudiantes el material concreto para que realicen la actividad en conjunto.
- Cuente y ordene 36 cubos de unidad. Forme 3 grupos de 10 unidades y deje en un grupo aparte el resto de los cubos, asegúrese de que los estudiantes realicen el trabajo junto con usted.
- Muestre el modo de representar las tablas de valor posicional:

9

In *Everyday Mathematics*, each lesson starts with a summary of what the lesson involves broken into three parts (warm-up, focus, and practice). The next page has differentiation options. Next the book details each step including pictures of the student journal and workbook pages (see figure 4). The final page of each lesson includes a home link activity that can be sent home. Each lesson within each unit has the same format.



Standards and Goals for Mathematical Practice

SMP1 Make sense of problems and persevere in solving them.
GMP1.5 Solve problems in more than one way.

SMP2 Reason abstractly and quantitatively.
GMP2.1 Create mathematical representations using numbers, words, pictures, symbols, gestures, tables, graphs, and concrete objects.

SMP3 Construct viable arguments and critique the reasoning of others.
GMP3.1 Make mathematical conjectures and arguments.

NOTE Throughout this and other lessons involving money, be sure to use different money notations, such as 25¢ and $0.25 or 100¢, $1, and $1.00. Although children are not yet expected to use the $ symbol and the decimal point, exposure to various money notations in class prepares children for exposure to them in everyday life. In addition, learning to use both $ and ¢ symbols correctly is a Grade 2 goal.

1 Warm Up 15–20 min Go Online

Mental Math and Fluency

Have children count by 5s, 10s, and 25s. Children may refer to the Number-Grid Poster or the Class Number Scroll as they count.

Leveled exercises:

●○○ Begin at 5. Count by 5s to 100. 5, 10, 15, 20, . . . , 100
Begin at 20. Count by 10s to 100. 20, 30, 40, 50, . . . , 100
Begin at 0. Count by 25s to 150. 0, 25, 50, 75, . . . , 150

●●○ Begin at 50. Count by 5s to 150. 50, 55, 60, 65, . . . , 150
Begin at 140. Count by 10s to 250. 140, 150, 160, 170, . . . , 250
Begin at 100. Count by 25s to 300. 100, 125, 150, 175, . . . , 300

●●● Begin at 115. Count by 5s to 200. 115, 120, 125, 130, . . . , 200
Begin at 153. Count by 10s to 253. 153, 163, 173, 183, . . . , 253
Begin at 175. Count by 25s to 350. 175, 200, 225, 250, . . . , 350

Daily Routines

Have children complete daily routines. See the Planning Ahead note in Lesson 5-1 for an adjustment to the Temperature Routine that will prepare children for Lesson 5-10.

2 Focus 30–40 min Go Online

Math Message

Take 10 (P), 6 (N), 6 (D), and 4 (Q) from your toolkit. How much money is that?
200¢, $2, or $2.00

Finding the Total

WHOLE CLASS | SMALL GROUP | PARTNER | INDEPENDENT

Math Message Follow-Up Ask children to share their strategies and justify their answer for finding the total value of the coins. GMP3.1
Model the following strategies:

- Count the coins in order of value, from largest to smallest. First count the 4 quarters by 25s to reach 100¢, or $1. Then count the 6 dimes by 10s to reach 160¢, or $1.60. Then count the 6 nickels by 5s to reach 190¢, or $1.90. Finally, count the 10 pennies by 1s for a total of 200¢, or $2.
- Make exchanges: 10 pennies for a dime, 4 quarters for a $1 bill, and so on.

In *Guía Didáctica del Docente*, the chapter on addition and subtraction that I will be analyzing is the first chapter in the book out of a total of twelve chapters. It has 43 pages and nine lessons. The other chapters that cover addition and subtractions are chapters two, three, and four. These each have eight, thirteen, and 34 pages respectively.

In *Everyday Mathematics* the chapter on addition and subtraction that I will be analyzing is the fifth chapter in the book out of nine chapters in the book. It has 90 pages including the assessment, which I will not analyze. There are 69 pages that I will analyze from this chapter, which makes up 11 lessons. The other chapters that cover addition and subtraction are chapters three and seven. They each have 90 and 76 pages respectively.

Collection of Data

I recorded two types of verbs. The first type was the verbs used to instruct the teachers on what to do with the students. These were words such as display, discuss, asignar (assign), and observar (observe). The second was the verbs used on the pages that had the pictures of the corresponding student workbook pages. This included words such as draw, solve, ordenar (order), and encontrar (find). I also recorded the words that described the method being used (mental, visual, etc) and any time manipulatives were used (number line, blocks, etc). I continued to add new words that appeared up through the last lesson.

I did a content analysis of the verbs in a chapter in each teacher manual. I followed the directions that Krippendorff detailed in his book, *Content Analysis: An Introduction to its Methodology*. Since the data that I was analyzing was written, it was symbolic in nature, which did not require transcribing, so it could automatically be processed (Krippendorff, 1980), which allowed me to go directly to collecting data.

I started by tallying the number of times each verb was used on a single page for each page in the lessons. This way I had a verb count for each page, which allowed me to

be able to recheck my "sort" on any page at any time. This also allowed me to continue where I left off with ease.

Once I had tallied up the number of each collected verbs per page, I then entered the number of tallies for each word on a spreadsheet, organized by page number. I organized the spreadsheet with all the words going down on the left and the different page numbers going across, so each column contained the words for one page and the rows were the total for each word. The words on the left were organized alphabetically.

Analysis

Krippendorff also discusses the importance of putting words into categories. To do this I used Bloom's Taxonomy. In his text, Krippendorff (1980) cites Miller saying, "This can be accomplished by putting a wide variety of different word patterns in a single category" (p. 71). Using the different levels of Bloom's Taxonomy allowed me to put multiple words into the same category, so that instead of looking at hundreds of different words, I could analyze them based on the six categories that Bloom has defined.

After I had entered all the words and totaled them, I sorted them based on Bloom's Taxonomy. The levels of Bloom's Taxonomy are *remember, understand, apply, analyze, evaluate,* and *create*. Bloom's Taxonomy is frequently used in education as a measure of the different level of tasks students are asked to do. This is what I did to compare the two texts. The lower three levels: *remember*, *understand*, and *apply*, use words that require lower level thinking. The upper three levels: *analyze*, *evaluate,* and *create*, use words that require higher level thinking. In order to sort the words, I made three rules to help with accuracy and consistency. These were: 1) consult the definitions

from Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths, and Wittrock's text, 2) refer to the chart that has mathematical terms sorted into Bloom's Taxonomy from *Early Learning Matters* (Early Learning Matters) 3) refer to my previous schema from courses I have taken in the School of Education where we learned about the levels of Bloom's Taxonomy and how to apply this to situation.

As I tallied the words, I noticed that the teacher's manual of *Everyday Mathematics* had many more words than the *Guía Didáctica del Docente*, which is why after I totaled up the number of words, I used the percentages for analysis instead of the number of times the word appeared. This allowed my comparisons to be more accurate and comparable.

After creating a chart organized by the six levels of Bloom's Taxonomy using the percentages, I turned the percentages into pie charts so that I could easily compare the levels between the two teacher manuals for each of Bloom's six categories. With the pie charts, I could visually see the distribution of the different levels. I also used bar graphs to see the difference in the percentages from the two math teacher's manuals right next to each other.

After I analyzed the percentage of words that appeared in each category of Bloom's Taxonomy from each math teacher's manual, I also compared the number of different words that were used in each category. Did one book only have five different words in the "create" category, while the other book had 20? This required me to look at the number of different words compared to the total words in order to create ratios that were not skewed by one book being more wordy than the other.

Limitations

Although I executed this research with the highest degree of accuracy possible, there are always limitations that come with research.

One of the most significant limitations in my research comes from the translation that is required in order to sort data into the levels of Bloom's Taxonomy. Although I tried my best to make sure this translation was accurate, which included consulting experts when needed, since Spanish is not my first language, there are bound to be some inconsistencies. Translations are often subjective, as can be seen in the translation section, so even with the accuracy of my Spanish, inconsistencies happen between translators. Additionally, since English is my first language, I will automatically be slightly biased towards the math teacher's manual written in English. English is the language I have been reading and learning in for the majority of my life, so I am more familiar with the terminology and meaning of the words in English. All the math instruction I received was done in English, so the terms used in the *Everyday Mathematics* teacher's manual will align more to what I was taught than the *Mi Matematica* teacher's manual. This will make me naturally biased towards the *Everyday Mathematics* math teacher's manual, which will be a limiting factor of the research.

Another limitation is the fact that I am only analyzing one chapter from each math teacher's manual. The other chapters may have completely different approaches to the topic and may have verbs that would distribute on Bloom's Taxonomy much differently than how the chapters I analyzed distributed.

Finally, I made the rules to help me stay consistent with how I sorted words into the levels of Bloom's Taxonomy, but if someone else did the project they would most likely use different rules. Even if they did use the same rules, they might not use them the

same way that I did. There is no way to avoid this complication other than to detail the rules, as I have done, so that someone else doing the same analysis can see exactly what I did.

Chapter 4: RESULTS

Findings

When doing this project, my goal was to see how the language, specifically the verbs used to inform the teacher's instruction of addition and subtraction, in the math teacher's manual from Santiago, Chile was different from the math teacher's manual from Orono, Maine. To start my analysis, I identified every verb both math teacher's manuals used to teach the topic of addition and subtraction. In the *Mi Matemática* teacher's manual from Santiago, Chile, I counted 984 uses of verbs instructing teachers how to teach the topics of addition and subtraction. In the *Everyday Mathematics* teacher's manual from Orono, Maine, I counted 2,967 uses of verbs instructing teachers how to teach the topics of addition and subtraction. These are the numbers I considered for analysis.

After identifying all the verbs, I found that there were a wide variety of different verbs used. In *Mi Matemática,* of the 984 verbs used there was a total of 116 different verbs. While in *Everyday Mathematics,* of the 2,967 verbs used, there was a total of 196 different verbs. (See Figure 5) In *Mi Matemática*, "*contar" (count)* showed up 51 times and the word "*desafiar" (challenge)* showed up once. For example, in *Everyday Mathematics*, the word "*add*" showed up 140 times and the word "*clarify*" showed up one time.

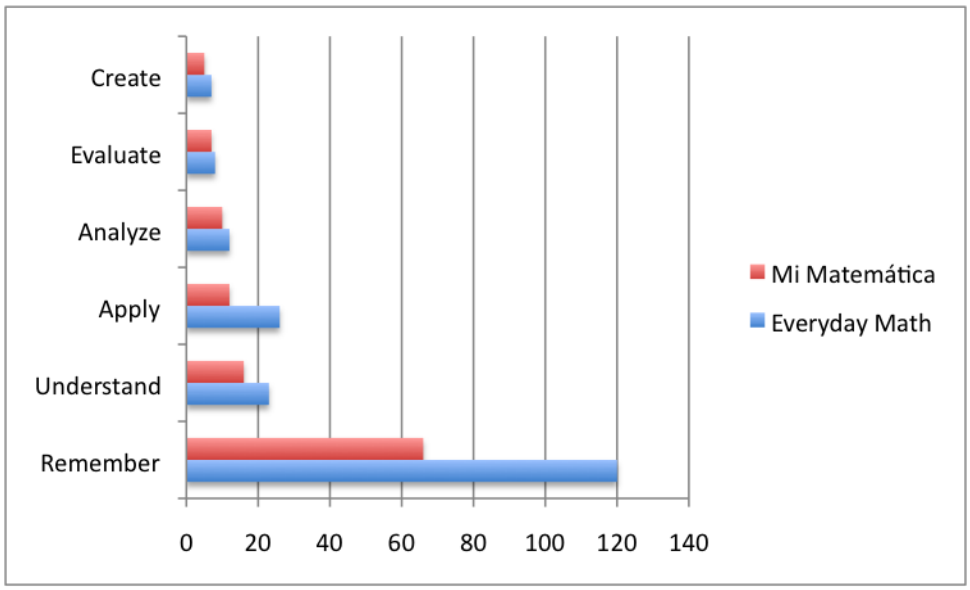


Figure 5.Number of different verbs used by level in Bloom's Taxonomy

After finding how many different verbs were used, I sorted each verb into a level of Bloom's Taxonomy, using my rules. I used the total number of times the words showed up at the level to find the percentages for each level of Bloom's Taxonomy (see figure 6, 7, and 8). For example, the word "*add*" showed up 140 times in the chapter, which is combined with the other words in the understand level. This 140 times was added with the other words at the understand level for a total of 498 words, which was divided by 2,967 to get 16.78 percent for this level. I did this same process for each level of Bloom's Taxonomy in each teacher's manual.

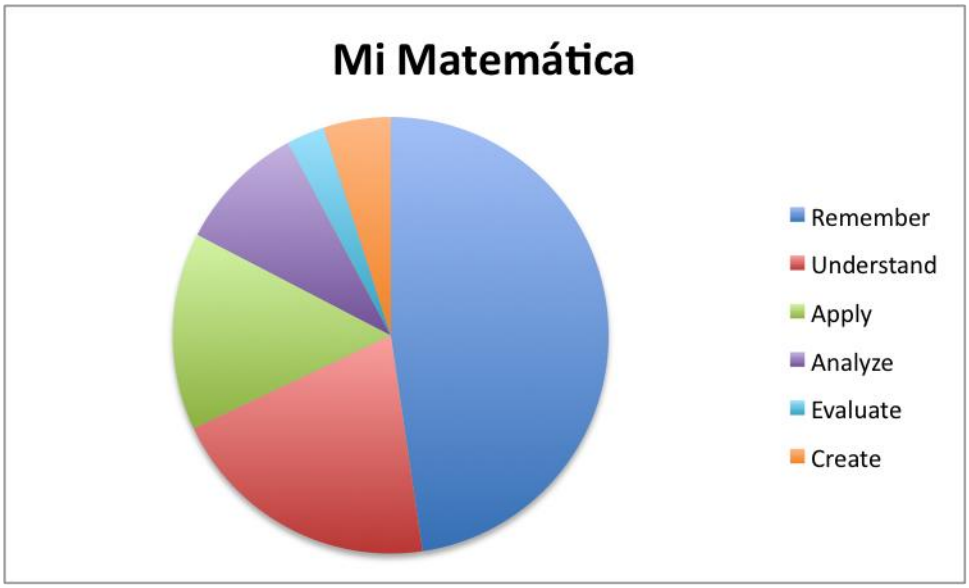


Figure 6.Percentage of verbs in Mi Matemática teacher's manual broken into the levels of Bloom's Taxonomy.

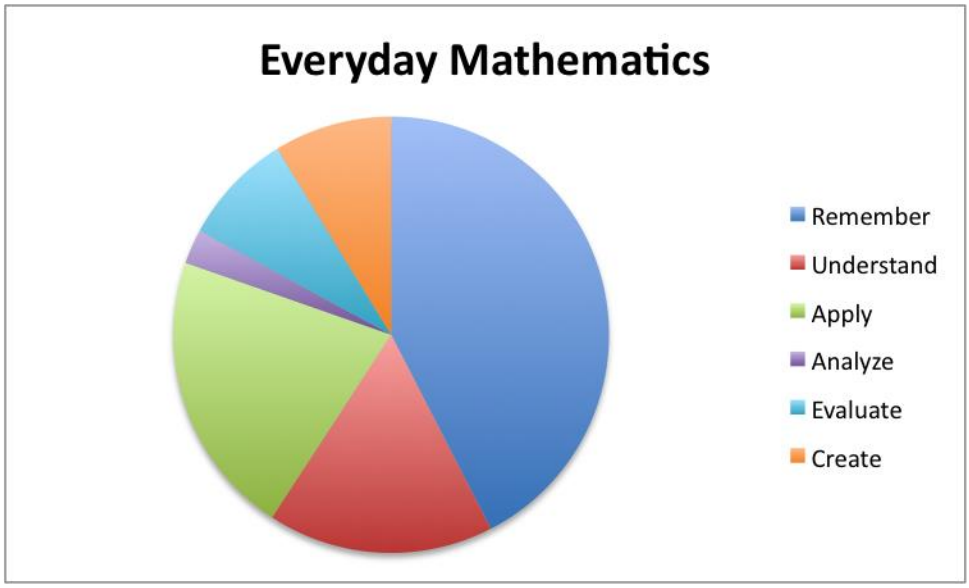


Figure 7.Percentage of verbs in Everyday Mathematics teacher's manual broken into levels of Bloom's Taxonomy.

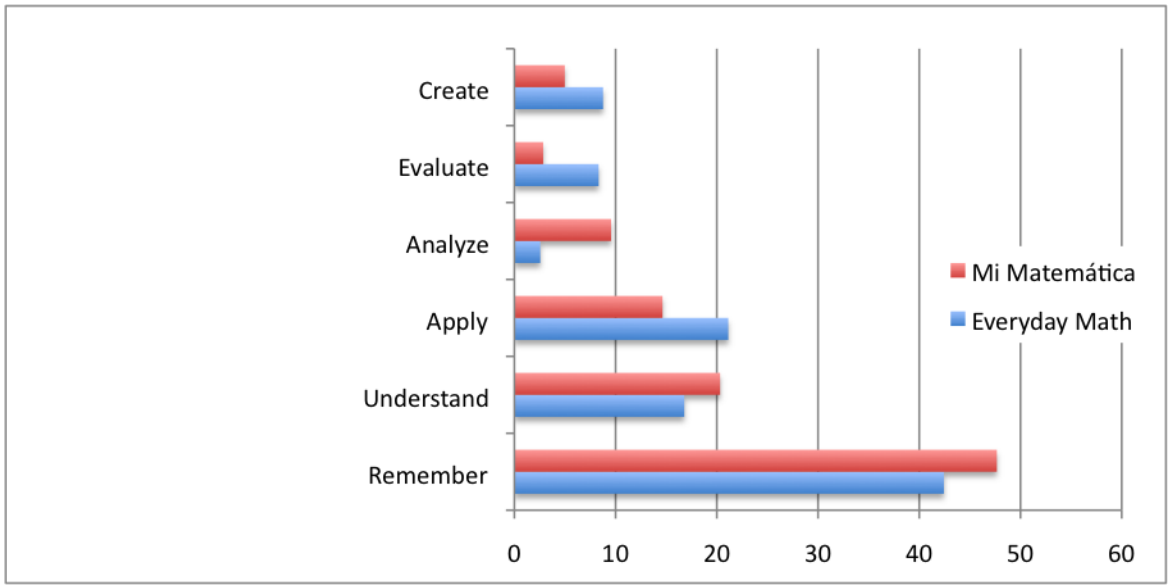


Figure 8. Percentages by level of Bloom's Taxonomy for each math teacher's manual.

Remember: Level 1 Bloom's Taxonomy

In the *Mi Matematica* teacher's manual I put 66 different verbs that inform the teacher's instruction of addition and subtraction into the *remember* category. These verbs were used a total of 469 times throughout the chapter. This accounted for 47.66 percent of the total words counted. Some words in this category were abrir (open), contar (count), copiar (copy), dibujar (draw), leer (read), and marcar (mark).

In the *Everyday Mathematics* teacher's manual I put 120 different verbs that inform the teacher's instruction of addition and subtraction into the *remember* category. These verbs were used a total of 1,259 times throughout the chapter. This accounted for 42.43 percent of the total words counted. Some words in this category were allow, color, copy, follow, move, and read.

When comparing the two teacher's manuals, the teacher's manual from Orono, *Everyday Mathematics,* used almost double the number of different words, 120 different

verbs compared to 66 different verbs in the teacher's manual from Santiago, Chile, *Mi Matematica*. They both had a similar percentage of total words that I put into the *remember* level. The Chilean teacher's manual had 47.66 percent of the words counted in *remember*, while the teacher's manual from Orono had 42.43 percent of the words counted in the *remember* level. There was a slightly larger percentage in the Chilean teacher's manual, but the bigger difference was in the number of different words.

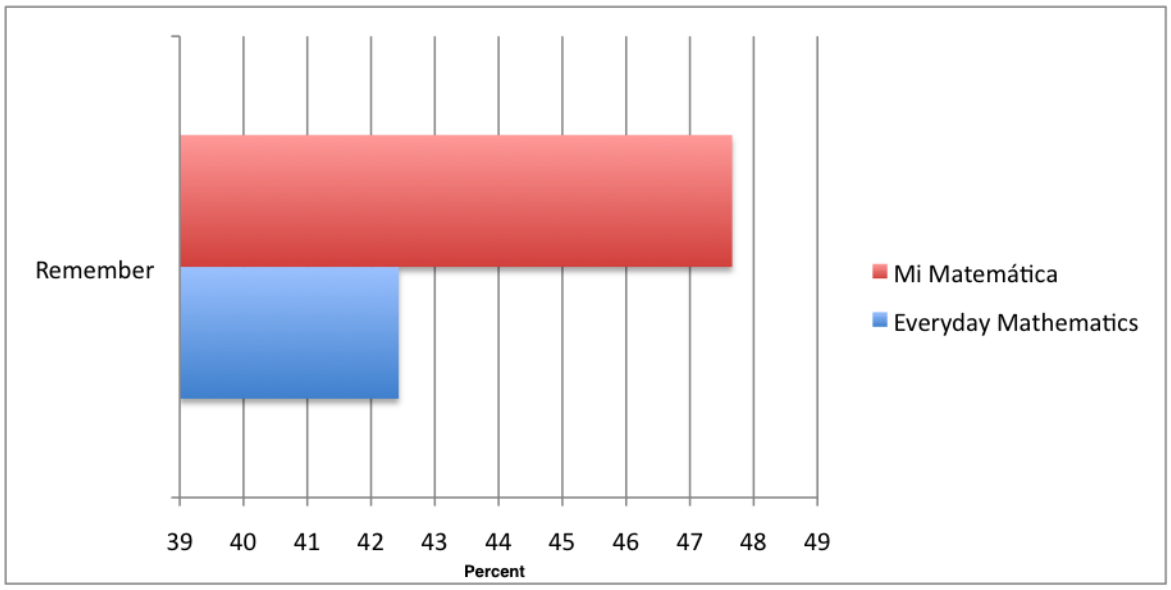


Figure 9.Percentages for Level 1: Remember

Understand: Level 2 Bloom's Taxonomy

In the *Mi Matematica* teacher's manual I put sixteen different verbs that inform the teacher's instruction of addition and subtraction into the *understand* category. These verbs were used a total of 200 times throughout the chapter. This accounted for 20.33 percent of the total words counted. Some words in this category were argumentar (argue), explicar (explain), guiar (guide), and sumar (sum).

In the *Everyday Mathematics* teacher's manual I put 23 different verbs that inform the teacher's instruction of addition and subtraction into the *understand* category. These

verbs were used a total of 498 times throughout the chapter. This accounted for 16.78 percent of the total words counted. Some words in this category were consider, estimate, model, separate, and subtract.

When comparing the two teacher's manuals, there were only sixteen different verbs used in the teacher's manual from Santiago, Chile compared to 23 different verbs in the teacher's manual from Orono, Maine. They both had a similar percentage of words that I put into the *understand* level. The Chilean teacher's manual had 20.33 percent of the words counted in *understand*, while the teacher's manual from Orono had 16.78 percent of the words counted in the *understand* level. There was a slightly larger percentage of words from the Chilean teacher's manual, which will be discussed later.

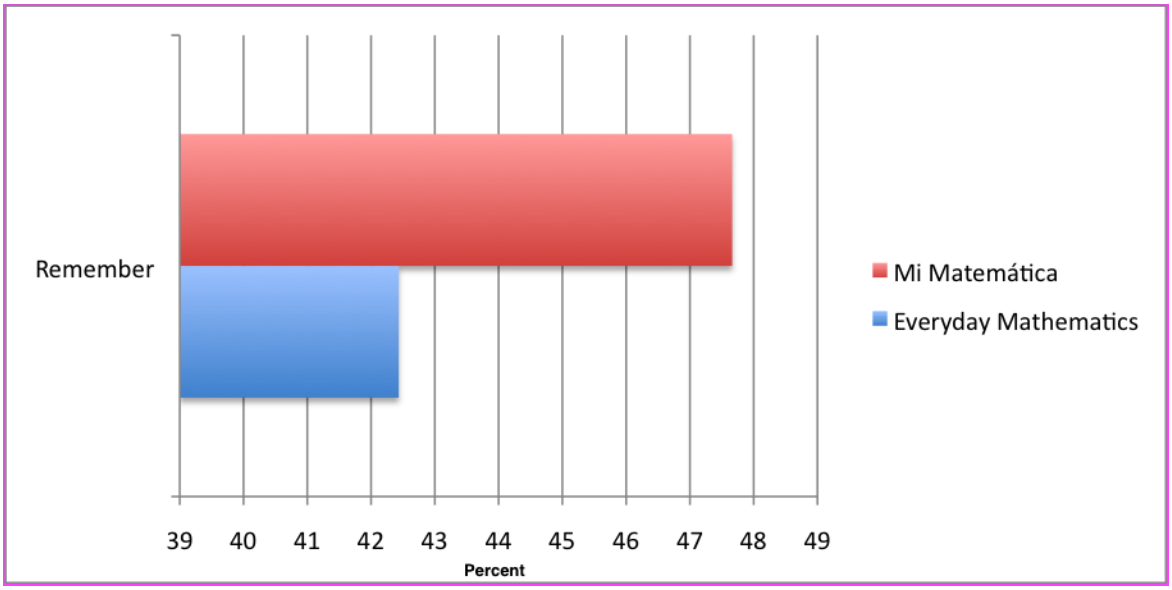


Figure 10.Percentages for Level 2:Understand

Apply: Level 3 Bloom's Taxonomy

In the *Mi Matematica* teacher's manual I put twelve different verbs that inform the teacher's instruction of addition and subtraction into the *apply* category. These verbs were used a total of 144 times throughout the chapter. This accounted for 14.63 percent

of the total words counted. Some words in this category were aplicar (apply), desomponer (separate), interpretar (interpret), and usar (use).

In the *Everyday Mathematics* teacher's manual I put 26 different verbs that inform the teacher's instruction of addition and subtraction into the *apply* category. These verbs were used a total of 627 times throughout the chapter. This accounted for 21.13 percent of the total words counted. Some words in this category were answer, calculate, represent, distribute, and solve.

When comparing the two teacher's manuals, there were also more than double the number of different verbs used in the teacher's manual from Orono at the *apply* level compared to the different verbs in the Chilean teacher's manual. There were twelve different verbs in the Chilean teacher's manual compared to the 26 different verbs in the teacher's manual from Orono. The teacher's manual from Orono had a larger percentage of words that I put into the *apply* level. The Chilean teacher's manual had 14.63 percent of the words counted in the *apply* level, while the teacher's manual from Orono had 21.13 percent of the words counted in the *apply* level.

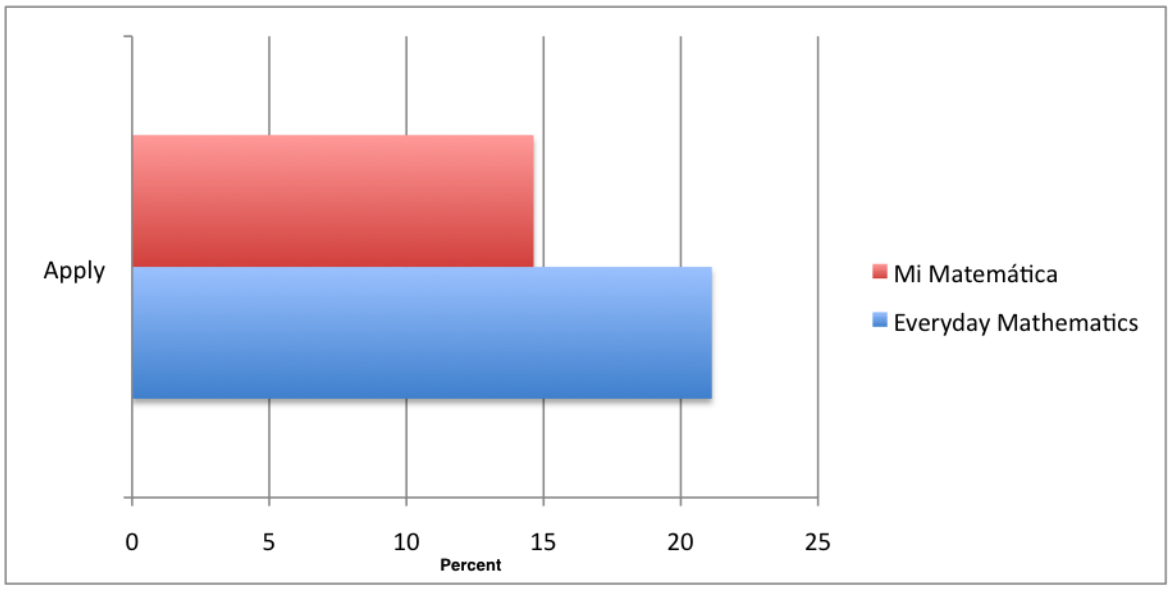


Figure 11.Percentages for Level 3: Apply

Analyze: Level 4 Bloom's Taxonomy

In the *Mi Matematica* teacher's manual I put ten different verbs that inform the teacher's instruction of addition and subtraction into the *analyze* category. These verbs were used a total of 94 times throughout the chapter. This accounted for 9.55 percent of the total words counted. Some words in this category were comparar (compare), corregir (correct), reforzar (reinforce), and utilizar (utilize/ use).

In the *Everyday Mathematics* teacher's manual I put twelve different verbs that inform the teacher's instruction of addition and subtraction into the *analyze* category. These verbs were used a total of 76 times throughout the chapter. This accounted for 2.56 percent of the total words counted. Some words in this category were analyze, compare, correct, examine, and reflect.

When comparing the two teacher's manuals, the teacher's manual from Orono had twelve different verbs in this category, while the Chilean teacher's manual only had

ten, despite having a larger percentage of verbs fall into this category. The percentage of words that I put into the analyze level differed greatly between the two different teacher's manual. The Chilean teacher's manual had 9.55 percent of the words counted in the *analyze* level, while the teacher's manual from Orono had 2.56 percent of the words counted in the *analyze* level. This was the smallest category in the teacher's manual from Orono, while it was the third smallest in the Chilean teacher's manual.

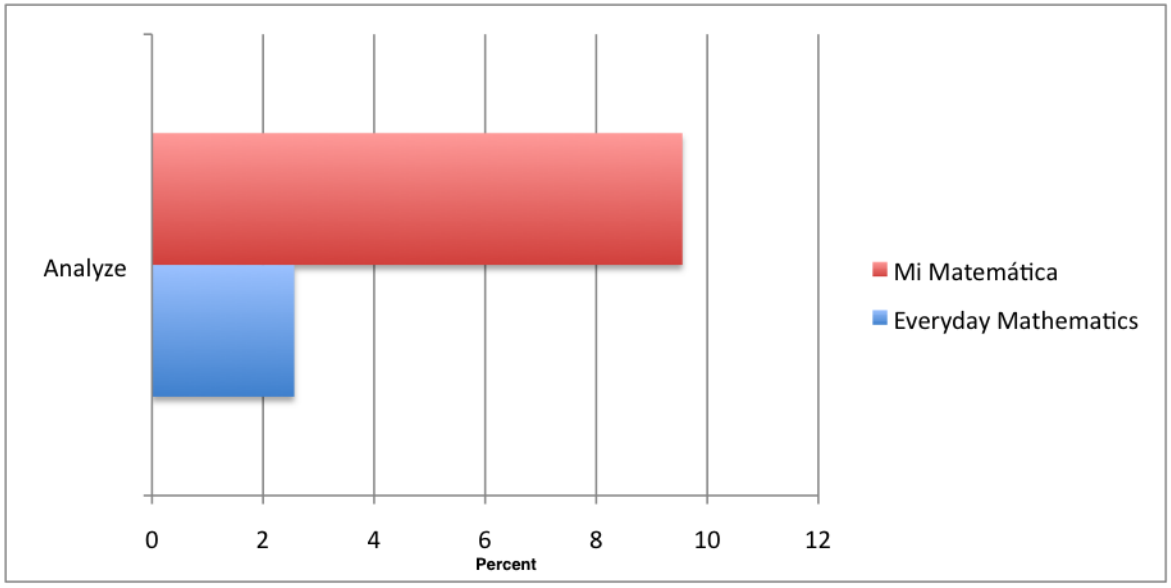


Figure 12. Percentages for Level 4: Analyze

Evaluate: Level 5 Bloom's Taxonomy

In the *Mi Matematica* teacher's manual I put seven different verbs that inform the teacher's instruction of addition and subtraction into the *evaluate* category. These verbs were used a total of 28 times throughout the chapter. This accounted for 2.85 percent of the total words counted. Some words in this category were cambiar (change), evaluar (evaluate), reflexionar (reflect), and verificar (verify).

In the *Everyday Mathematics* teacher's manual I put eight different verbs that inform the teacher's instruction of addition and subtraction into the *evaluate* category. These verbs were used a total of 247 times throughout the chapter. This accounted for 8.32 percent of the total words counted. Some words in this category were adjust, change, evaluate, modify, and support.

When comparing the two teacher's manuals, the teacher's manual from Orono used only one more different word than the Chilean teacher's manual in the *evaluate* level. The teacher's manual from Orono had more total verbs put into the *evaluate* level than the Chilean teacher's manual when you look at the percentages. The Chilean teacher's manual had 2.85 percent of the words counted in the evaluate level, while the teacher's manual from Orono had 8.32 percent of the words counted in the *evaluate* level.

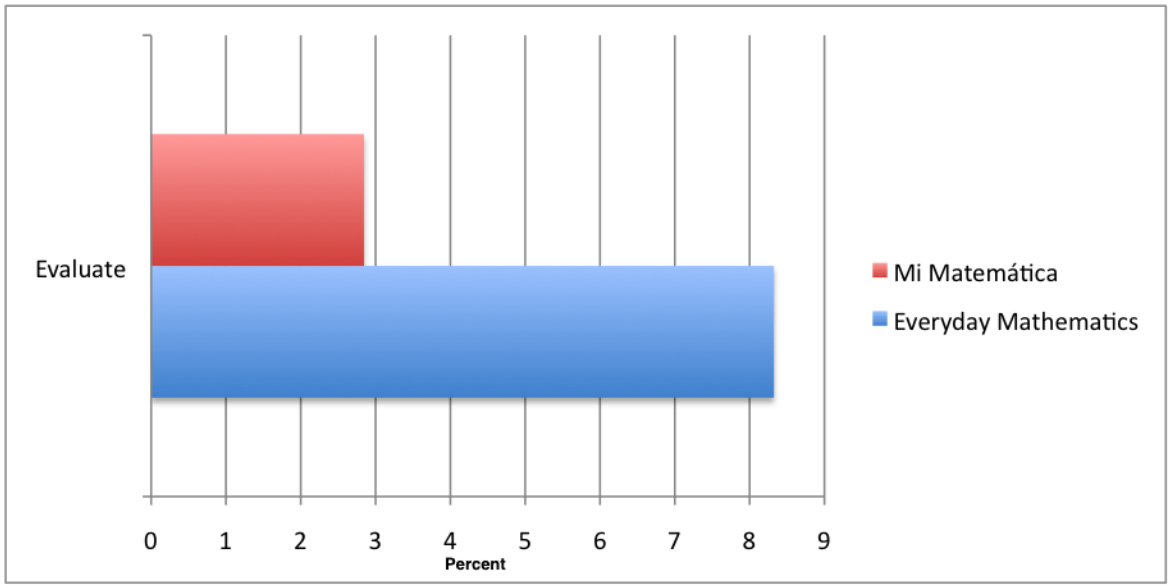


Figure 13. Percentages for Level 5: Evaluate

Create: Level 6 Bloom's Taxonomy

In the *Mi Matematica* teacher's manual I put five different verbs that inform the teacher's instruction of addition and subtraction into the *create* category. These verbs were used a total of 49 times throughout the chapter. This accounted for 4.98 percent of the total words counted. Some words in this category were construir (build), crear (create), desarrollar (develop), and escribir (write).

In the *Everyday Mathematics* teacher's manual I put seven different verbs that inform the teacher's instruction of addition and subtraction into the *create* category. These verbs were used a total of 260 times throughout the chapter. This accounted for 8.76 percent of the total words counted. Some words in this category were build, create, make up, and write.

When comparing the two teacher's manuals, the teacher's manual from Orono had a larger number of different verbs used than the Chilean teacher's manual, with seven in the teacher's manual from Orono and only five in the Chilean teacher's manual. The teacher's manual from Orono had a larger percentage of words that fell into the *create* level compared to the Chilean teacher's manual. The Chilean teacher's manual had 4.98 percent of the words counted in the *create* level, while the teacher's manual from Orono had 8.76 percent of the words counted in the *create* level.

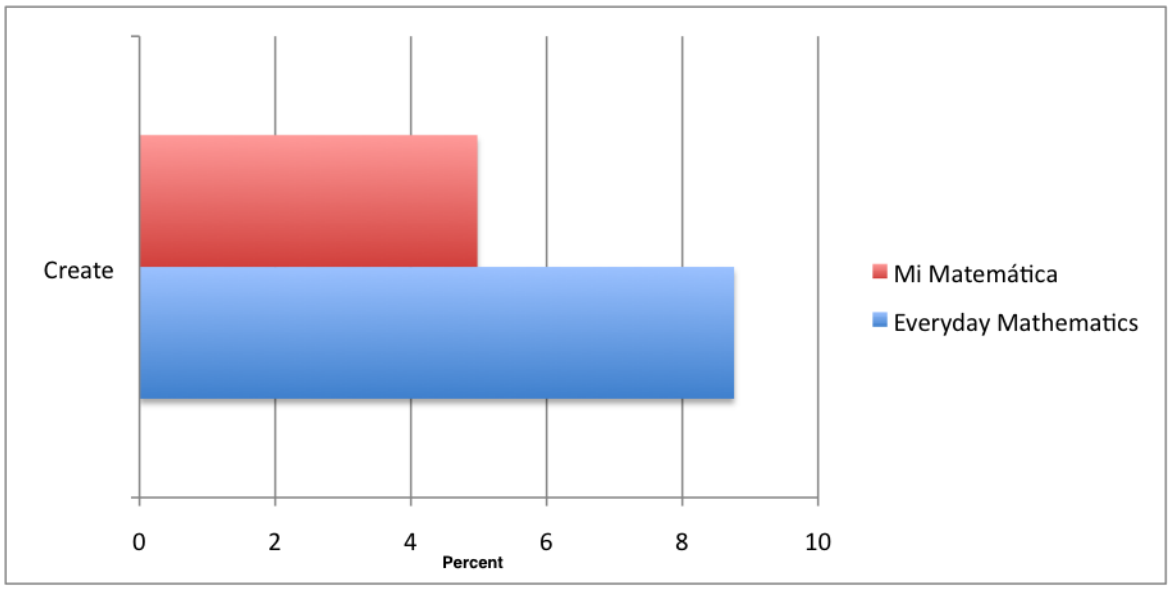


Figure 14. Percentages for Level 6: Create

Lower Order Thinking

The first three levels of Bloom's Taxonomy are considered the lower-order thinking levels. This includes *remember*, *understand*, and *apply*. When looking at these three levels in both of the teacher's manuals, the bigger disparity comes in the number of different words used for each. There were 169 different verbs used in the lower-order thinking in the *Everyday Mathematics* teacher's manual compared to 94 different verbs used in the *Mi Matemática* teacher's manual. This shows that although *Mi Matemática* has a slightly higher percentage of lower order words, there are fewer different words used to express this type of thinking.

They have very similar percentages. In *Mi Matemática*, 82.6 percent of the words counted fell into the lower-order thinking, while in *Everyday Mathematics* 80.3 percent of the words fell into the lower-order thinking. It is common for the lower-order thinking level to have a greater percentage of words compared to the higher-order thinking

because it is important to have a strong understanding of the topic (which comes from the lower-order thinking) before you are able to access the higher-order thinking skills. This can be seen in the pyramid shape of Bloom's Taxonomy, with the lower-order thinking questions being at the bottom and thus occupying a larger share of the total area of the triangle. Both of the math teacher's manuals are within two percentage points for the preponderance of lower-order thinking, showing that they have a similar number of verbs requiring this order of thinking.

Higher Order Thinking

The last three levels of Bloom's Taxonomy are considered the higher-order thinking levels. This includes *analyze*, *evaluate*, and *create*. When looking at these three levels in both of the teacher's manuals, they also have a similar number of different words used. In the *Mi Matemática* teacher's manual, there are 22 different verbs used that require higher-order thinking, while *Everyday Mathematics* has 27 different words used. The number of different verbs used in higher-order thinking is much more similar than the number of different words used in lower-order thinking.

Not only are both of the number of words similar, but they have very similar percentages, with the *Everyday Mathematics* teacher's manual having a slightly higher percentage. *Mi Matemática* has 17.4 percent of the words counted which fall into higher-order thinking, while *Everyday Mathematics* has 19.6 percent of the words counted in this category.

CHAPTER 5: DISCUSSION

Implications

Number of different verbs

As a future teacher, the biggest finding here is the disparity of the number of different verbs used in each category. Teaching second grade, students are presented with a plethora of different vocabulary words in all different subjects, so the more consistency in the vocabulary used, the easier it is to teach students skills such as addition and subtraction. Even small differences in wording can affect the performance of students in drastic ways. Saying "*stations*" instead of "*centers*" or "*workshop*" or "*group*" can confuse for students. This being said, a smaller number of different words is much more beneficial to students, especially younger students. Comparing the two textbooks, having 120 words make up 42.4 percent of the words is much different than having 66 words make up 47.7 percent of the words (see figure 15). This was the difference between the two *remember* categories of the *Mi Matemática* teacher's manual and the *Everyday Mathematics* teacher's manual. This is the only section that has such a significant difference. Since this is the lowest level on Bloom's Taxonomy, it is the level where the basis of the skill is taught. In order to be able to succeed at the higher levels, there has to be a strong foundation at this level. For example, in order to be able to write a specific number, you have to be able to point to the number one when asked what number is a number one. The *apply* section also has a similar disparity. Both of these are lower-order thinking skills, meaning that they must be understood to move to higher-order thinking skills. There are two schools of thought regarding whether having more words is beneficial or detrimental. One side is that it would be confusing to introduce students to

so many different words while they are learning the basic skill. The other side is that by presenting students with more words, you are preparing them for the different ways they may be asked to do tasks at this level and giving them a larger base of knowledge.

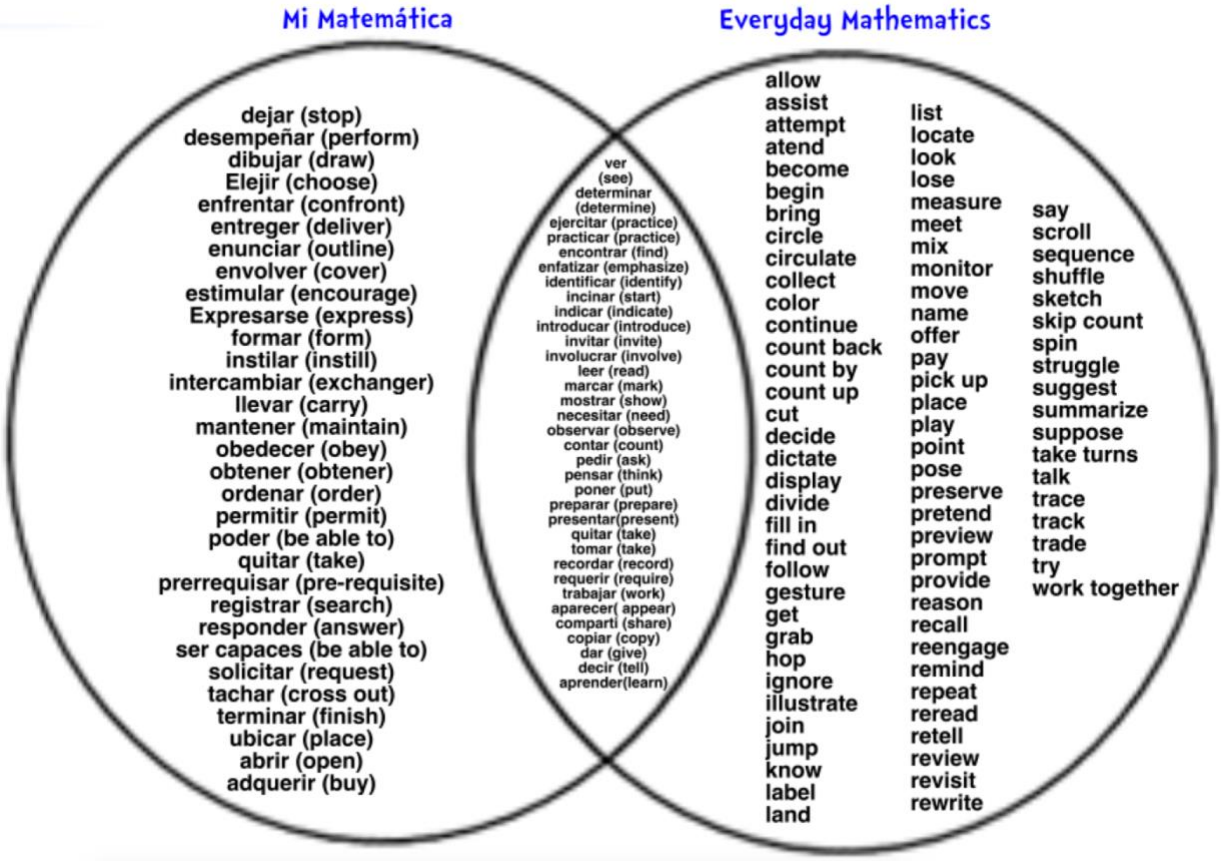


Figure 15. Words for the remember level sorted by the math teacher's manual.

Lots of words could be confusing. One argument is that by having more words, teachers will have to teach students twice as many different words, which means that they are going to spend less time practicing with specific vocabulary words and more time learning various ways of saying things. When students are being asked questions using a larger number of different words, they would not know what the question is asking, so they would have to have an equal, but lower level of overall understanding for each of

these words. They also will not have spent as much time mastering the actual tasks required to learn these concepts because they spent more time on vocabulary.

More words provide more vocabulary opportunities. The other argument is that by providing students more words at this basic level, they are gaining access to more words here, which may apply to the higher levels as well. As teachers, we want to prepare our students for the variety of words they will see later in life when doing addition and subtraction. If we expose students to more words while they are learning the basis of the topic, they will be more prepared later on when they are exposed to these words.

There is no doubt that there is a balance to the number of words. Going into my student teaching semester, one of my goals was to have clarity in my speaking. I wanted to make sure I used the specific wording that I was supposed to use and I spoke properly so that if students mimicked me, they would speak properly.

Although the *Everyday Mathematics* teacher's manual has more different verbs, it also has more words in general, with a total of 2,967 counted verbs compared to 984 in the *Mi Matemática* teacher's manual. The *Everyday Mathematics* teacher's manual gives teachers more scripted activity-by-activity instructions for each of the lessons in the chapter analyzed. This needs to be considered as well when looking at the number of different words in the teacher's manuals. It is logical that with more information, there will be more different words. In order to tell which is truly more effective, there would need to be an analysis of the classroom instruction and student performance in addition to the analysis of the teacher's manuals.

Percentages

Based on what I found through my data analysis, teachers in Santiago, Chile and Orono, Maine are presented with teacher's manuals which have a similar number of different verbs prompting higher- and lower-order thinking. For the most part, when teaching addition and subtraction, the teacher's manuals from both locations follow the traditional pyramid for the various levels of words based on Bloom's Taxonomy. There were some individual levels that had disparities in the percentage differences between the teacher's manual from Santiago and Orono. For example, the analyze level in *Mi Matematica* had 9.55 percent of the total words and in *Everyday Mathematics* there was only 2.56 percent of the total words at this level. Since the higher- and lower-order balance is similar between the two math teacher's manuals, the difference in percentages between the individual levels are not as significant for the purpose of this research.

Addition and subtraction are base-level skills that students continue to build on throughout their mathematical education. Because of this, students are fairly new to the concept in second grade. When students learn, there are many more lower-order thinking questions to ensure they have a secure and well-developed base of understanding. Because of the necessity of this base, it is logical that there be so many more lower-order thinking verbs compared to higher-order thinking verbs.

The student's developmental stage is also an important factor when considering this pyramid structure. When working with a class of 20 second-grade students, having them all create things, which is a higher-order thinking, requires that they be able to work independently. In the classrooms that I have experience in, at the second-grade level, I

have seen that in order for students to do tasks that require them to create or evaluate (higher-order thinking), they need more teacher support than an older student would require, or than what they would need for a task that requires them to *remember* or *understand*. Logistically, with one teacher in the room, and all the students needing some form of support to do higher-order thinking tasks, it is logical that more lower-order tasks will occur, so that the teacher can devote attention to helping with these higher-order tasks when they come along.

Another important thing to consider is the location of the chapters. In the *Mi Matemática* teacher's manual, the chapter I analyzed was the first chapter in the teacher's manual out of twelve chapters for the year. This means that this would be the first math chapter taught to students in the second grade. A second grader in September is much different from one in March developmentally. A second grader at the beginning of the year will need much more support in order to be able to do any tasks that require higher-order thinking. For this reason, it would make sense to have more lower-level thinking verbs for these units, which fall early in the year.

The chapter that I analyzed in the *Everyday Mathematics* teacher's manual was the fifth unit in the book out of nine. This means this unit would be taught mid-year, when the students are still not ready for as many higher order skills. It takes much of the year for students to learn routines and become comfortable with the classroom routines, so by mid-year they have typically just gotten in the groove of routines.

In both the teacher's manuals, there were a few different chapters that had addition and subtraction so later chapters on addition and subtraction might have a higher percentage of words falling into the higher-level thinking when compared to these

chapters. In *Mi Matemática* these were chapters two, three, and four, which would fall later in the year. In *Everyday Mathematics* these chapters were three and seven, one of which would also fall later in the year.

Suggestions for Further Research

This research is the basis for many potential projects comparing these two teacher's manuals and even these two approaches of teaching math. As I did this research, I thought of countless other projects that could be done to extend the research I am doing. Three of these are: 1) a comparison of all the chapters on addition and subtraction in the math teacher's manuals, 2) a comparison of the entire teacher's manuals versus each other, and 3) a study to see if Spanish or English is a more effective language to teach students mathematics concepts.

The first most obvious continuation of research would be to compare all the chapters relating to addition and subtraction from the two math teacher's manuals. I looked at a single chapter from each text. In the Chilean math teacher's manual there were four with a focus on addition and subtraction and in math teacher's manual from Orono, there were three total discussing addition and subtraction. This could be done using the same methodology that I used for my research. It would be more time consuming, but if this was done, the distribution on Bloom's Taxonomy could be compared as a whole to a whole unit or chapter-to-chapter. In doing this, you could also see if the level of higher-level thinking verbs were higher in later chapters in either of the books.

Another fairly obvious future project could be analyzing the entire math teacher's manual from each location and collecting all the verbs that inform the teacher's instruction. This could then be compared to see how the beginning of one math teacher's manual was different from the same teacher's manual as well as how it was different from math teacher's manual from the other location. This would be interesting to see if the beginning of the math teacher's manual had a greater percentage of lower-level verbs in both teacher's manuals or just in one. It would also be interesting to see if different topics covered in different chapters have different distributions of verbs across Bloom's Taxonomy. You could also analyze the math teacher's manuals on more than just the verbs. For example, it might be interesting to see how the manipulatives differ based on the different location or how the topics are taught using different techniques. This could also be analyzed using a content analysis, but there would need to be another way of sorting the words because Bloom's Taxonomy would not work for these.

Ultimately, it would be interesting to see if Spanish or English is a more effective language to teach mathematics. This could be done at a bilingual school. Students could be split into two groups and all students then given a pre-test in both languages. After this, the students would be split based on the language they are being taught in, Spanish or English. They would be taught for a set amount of time in the target language. The only thing that would be different would be the language. The same activities would be done and the same amount of time spent on each topic no matter which language they were being taught in. After this they would be given post-tests and the two groups would be compared to each other. This would be tricky to do because it would have to be repeated many times with different groups of students and over different math concepts.

Additionally, the students would have to be truly bilingual or else one language would be easier for them than another. Doing a study like this would be time consuming, but it could determine the future of both bilingual education and math education.

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APPENDIX:

A. Verbs from both math teacher's manuals

Verbs from *Everyday Mathematics*	**Verbs from *Mi Matematica***	
	Word (Spanish)	*Translation*
answer	Aplicar	apply
Apply	calcular	calculate
benefit	Demostrar	demonstrate
calculate	descomponer	separate
choose	Emplear	employ
clarify	explorar	explore
correspond	Interpretar	interpret
do	Relacionar	connect
Draw	Representar	represent
engage	resolver	resolve
Exchange	seleccionar	classify
Explore	Usar	use
figure out	Analizar	analyze
instruct	asegurarse	check
interpret	Comparar	compare
pair	Comprobar	check
Refer	Corregir	correct
Represent	desafiar	challenge
Respond	lograr	manage
Solve	Reforzar	reinforce
Use	Revisar	revise
Demonstrate	Utilizar	use
Distribute	construir	build
plan	crear	create
relate	desarrollar	develop
analyze	Realizar	make
Check	Escribir	write
Compare	cambiar	change
consolidate	evaluar	evaluate
correct	reagrupar	regroup
examine	Reflecionar	reflect
Improve	Regrupar	regroup
Justify	repasar	check/ revise
match	Verificar	verify
organize	verificar	verify
reflect	abrir	open
revise	adquerir	buy
build	Aparecer	appear
Construct	Aprender	learn
Create	compartir	share
Develop	Completar	complete
Make	Comunicar	inform
make up	Contar	count

Write	copiar	copy
adjust	Dar	give
assess	Decir	tell
change	Dejar	stop
Critique	desempeñar	perform
evaluate	determinar	determine
manipulate	Dibujar	draw
Modify	ejercitar	practice
support	elegir	choose
Allow	Encontrar	Find
Appear	enfatizar	emphasize
Ask	enfrentar	confront
assist	Entreger	deliver
attempt	enunciar	outline
attend	envolver	cover
become	estimular	encourage/stimulate
begin	expresarse	express
bring	Formar	form
Circle	Identificar	identify
Circulate	incinar	start
collect	Indicar	indicate
color	instilar	instill
Complete	Intercambiar	Change/exchange
continue	introducar	introduce
copy	invitar	invite
Count	involucrar	involve
count back	Leer	read
Count by	llevar	carry
count up	mantener	maintain
Cut	marcar	mark
Decide	Mostrar	show
Determine	necesitar	need
dictate	obedecer	obey
Display	Observer	observe
divide	obtener	obtain
Emphasize	Ordenar	order
Fill in	Pedir	ask
Find	pensar	think
find out	permitir	permit
follow	poder	to be able to
Gesture	Poner	put
Get	practicar	practice
give	preparar	prepare
Grab	prerrequisar	pre-requisite
hop	presentar	present
identify	proporcionar	provide
ignore	quitar	take
illustrate	Reconocer	recognize
indicate	recordar	record
introduce	Registrar	Search/record
invite	requerir	require

involve	responder	answer
join	ser capaces	be capable of
jump	solicitar	request
Know	tachar	cross out
label	terminar	finish
land	Tomar	take
learn	Trabajar	work
List	ubicar	place
locate	ver	see
Look	agregar	add
lose	argumentar	argue
Mark	comprender	understand
Measure	considerar	consider
meet	describir	describe
Mix	descubrir	describe
monitor	discutir	argue
Move	dominar	dominate
Name	ensenar	teach
need	establecer	establish
notice	Explicar	explain
Observe	Guiar	guide
offer	restar	subtract
Pay	separar	separate
pick up	sumar	sum
Place	sumar 10	sum 10
Play		
point		
Pose		
Practice		
Prepare		
present		
preserve		
pretend		
preview		
prompt		
Provide		
Put		
Read		
reason		
recall		
Record		
reengage		
Remind		
Repeat		
require		
reread		
retell		
Review		
revisit		
rewrite		
say		

Scroll
See
Select
sequence
Share
Show
shuffle
sketch
skip count
Spin
start
struggle
suggest
summarize
suppose
Take
take turns
Talk
Tell
Think
trace
Track
Trade
try
want
Work
work together
Add
Combine
confirm
Consider
describe
Discuss
Encourage
Estimate
Expect
Explain
generate
guide
Help
Maintain
make sense
Model
persevere
report
Separate
Subtract
Sum
translate

B. Table with number of different words used

Everyday Mathematics	Remember	120
	Understand	23
	Apply	26
	Analyze	12
	Evaluate	8
	Create	7
	Total diff. words	196
Mi Matemática	Remember	66
	Understand	16
	Apply	12
	Analyze	10
	Evaluate	7
	Create	5
	Total diff. words	116

C. Table with percentages of words for each level

	Level	Total times	percentage
Everyday Mathematics	Remember	1259	42.4334344
	Understand	498	16.7846309
	Apply	627	21.132457
	Analyze	76	2.56150994
	Evaluate	247	8.32490731
	Create	260	8.76306033
	Total words	2,967	
Mi Matemática	Remember	469	47.6626016
	Understand	200	20.3252033
	Apply	144	14.6341463
	Analyze	94	9.55284553
	Evaluate	28	2.84552846
	Create	49	4.9796748
	Total words	984	

AUTHOR'S BIOGRAPHY

Jordan Elizabeth Houdeshell is in her final semester at the University of Maine, where she studies Spanish and Elementary Education with concentrations in mathematics and English Language Learning. She was born on June 8, 1996 in San Diego, California to Jack and Diane Houdeshell. She moved around the United States as a child, since her father was in the U.S. Navy. She graduated from Ledyard High School in Ledyard, Connecticut in 2014. During her time at UMaine, she was a member of the All Maine Women, Kappa Delta Phi, Black Bear Mentors, and served as Editor in Chief of the Maine Campus. She studied in Mexico for three weeks, teaching English at a preschool. She also studied abroad in Santiago, Chile for four months. She enjoys traveling, running, and reading. She will graduate Summa Cum Laude with a double degree. She hopes to pursue a career in Elementary Education post-graduation, working with students speaking Spanish as a first or second language.