

Solving Problems through Problem Solving

Naalglosi Wolt'a Bahane

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Diné Institute for Navajo Nation Educators (DINÉ)

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Author Note:

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About the Author

I am a mother, sister, wife, friend, co-worker and Native American- Navajo woman. I live in Many Farms AZ, and work in Chinle AZ, but originally, I come from White Cone, AZ. I am of the Na'toh Diné (Tabacco People clan), born for To'ahani (Near the Water clan), and my maternal grandfathers are Tse'nijikini (the Cliff Dweller clan) and my paternal grandfathers are Kin'yaa'aanii (the Towering House clan). I have 4 kids, 2 cats, and 2 dogs. I have 15, 13, and 11 year old daughters and a 4 year old son, Kylyn. I enjoy hanging out with them and traveling with them. We love going to National Parks and hiking. There is never a dull moment. Our cats are Onyx, who belongs to my oldest- Kymya, and Me Laf aka "Meat loaf" who belongs to my second oldest- Raidanna. They enjoy their cats. My youngest daughter, Aurora, and my son don't have any pets. If anything, they share the dogs with me. Reign and Tia are our family dogs. Tia is 12 years old and Reign is 2 years old. That's pretty much about myself and my family.

Introduction

This is my very first full year with the DINÉ Institute and I am participating in the Solving Problems with Problem Solving Mathematics seminar. I was excited to learn and gain a better understanding in math problem solving and to be able to teach it to my students. This unit covers problem solving through the use of incorporating the Singapore Math Strategy to help students understand how to solve problems using the Tape Strategy approach, as well as other strategies used within the classroom. Students will have a better understanding of how to use the strategy and what it entails when breaking down the word problem.

Context

Community Demographics

Currently, my community is Chinle/Many Farms area. It's somewhat different from previous places that I have been working at. It's in a very rural location. I work with Chinle Unified School District #24, where there are a total of 5 elementary schools scattered across the valley- 2 of which are located in Many Farms and Tsaile, about 15 and 30 miles north and northwest of Chinle. The district has a junior high school and a high school for upper grades. The school district also has an online school called the Nizhoni Online Academy, for K-12 students, where teachers throughout the district are chosen to teach these classes. The district hosts about 3,000+ students total. The district covers several communities including: Chinle, Many Farms, Round Rock, Lukachugai, Tsaile, Wheatfields, Del Muerto, Spider Rock, Nazlini, Burnside, Pinion, Blue Gap, and Hard Rock.

The Canyon De Chelly Elementary School has about 255 to 300 students whom the building serves. We do have a preschool program within our building that hosts about 12-18 kids per school year. Of the student count, about 10 percent of the students are classified as English Language Learners (ELL); they are provided instructional assistance in their classrooms, called the pull out program, on how to improve their learning and understanding in classroom work provided in English. Students practice oral and written language in English to help them become better writers and readers. Approximately 5 to 7 percent of students are classified as SPED in our

building, where accommodations and modifications are made to help them learn in school. Our building is known to take in students with behavioral needs and thus we do our best to provide the best possible behavioral interventions possible. Our school building is 98% Native American- Navajo, 1% African American, and 1% White. We have two to three teachers per grade level, depending on the class size. Currently our biggest class size is the 3rd grade, where there are 26 students enrolled.

Other local Chinle demographics include three convenient stores- a Speedway, a Chevron, and a Conoco. There is one grocery store, Bashas. The town also has many Navajo Nation Departments that are scattered across the main streets that run through the community, including a chapter house, Az Department of Transportation. There are 2 hotels, one being a Holiday Inn. They have several fast food areas including Burger King, Churches, Subway, Pizza Edge, Pizza Hut Express, and Junction Restaurant. Also, there is a police department, fire department and several churches in the area. Lastly, Chinle also has an Indian Hospital that sits at the top of a mesa.

The Chinle community is a close knit community when it comes to kinship of the Navajo families. People either know one another or they don't. It depends on the house location they come from. Based upon this, as a teacher, I am able to gauge where my students come from, household wise, and have some insight as to what their behavior will be like. For example, I had a student whose grandparents were raising her brothers and sisters. She talked about how there were so many of them that they didn't have time to fix her hair. I would spend time trying to fix her hair before school started. The next year, I found out that I had her brother, so I knew what kind of grandparents he had and it was easier to make a connection to what his family was going through because I already knew from the sister the year before. Circumstances like this let me know whether students might come from a supportive family or if they will need extra encouragement to be on track. You learn about students each year, when their youngest sibling comes up to your grade level. The community does encourage education, they are supportive of academic achievement as they encourage teachers and staff to review data quite often. A majority of community members and parents are normally on board with what the school offers in terms of afterschool activities, parent night, Parent-Teacher Conferences, sport programs, and Cheetah Nights, as our building calls it. This is where teachers teach parents about standards they are teaching and provide education on how they should teach it at home and what strategies they could use. It's rare that you have a parent who disagrees with what the school is offering when it comes to expanding their child's learning. Even more so now, after the pandemic, parents are seeing the impact of keeping their children at home as opposed to having them in school.

Rationale

Past School Year (2021-2022)

Teaching 1st grade at Canyon De Chelly Elementary School, it was quickly noticed that some students were never in school due to Covid. However, this past school year was their first year in school, in person, due to the pandemic. Most of my students started pre-school and then skipped their Kindergarten year, and came back as 1st grade. Many families did not want to put their child back in school for fear of them catching the virus. Some areas of re-teaching that had to be

addressed were in social emotional, reading, writing, and all areas of math. Most of the students had to be retaught how to act within a classroom. This was across all grade levels. This was one of the weaknesses we noticed as teachers. Another area lower grade levels (K-1) needed to improve on, this school year, was in the area of number sense, operation of algebraic form and problem solving. Many of the students this school year did not know how to break down a word problem given to them. Keywords, such as sum, more, less than, take away, etc., or whether to add or subtract were not understood. So, teaching these key terms is one part of helping students to understand what the problem is asking them to do.

It is important for our students to be able to see and understand what they are learning. We use various methods in our classroom subjects, such as reading, writing, math, science, and social studies lessons to help students understand the standards we are trying to teach them. The Curriculum and Evaluation Standard for School Mathematics states that “one of its five general goals is for all students to become mathematical problem solvers... to develop such abilities, students need to work on problems that may take hours, days, and even weeks to solve” (Mikusa, 1998, p. 20). I want my students to know that the math problem solving lessons are strategies that could be used in real life and do have also have roots to our culture and the history of who we are as Navajos. We are learning to expand our thinking and our minds and “problem solving allows students to develop understanding and explain the process used to arrive at solutions that then remember and apply a set of procedures” (Klertein & Harvey, 2022, p 2). I believe that once students understand this reason, they will start to take into account how learning problem solving skills can help them to better explain what they are thinking and how they came to that solution. Furthermore, studies state that “... students actively engage in learning mathematics through doing, talking, reflecting, discussing, observing, investigating, listening, and reasoning” help them to think more about ways they can expand their thinking (Klertein & Harvey, 2022, p 2). Instead of just thinking of it as stories/problems needing to be read and numbers they have to make sense of, students have to solve and transfer it to their own understanding and later be able to reflect and use it when they are at home or at the store, or even better yet come up with where they would use it. Though I teach first grade, I think it is something that they need to be exposed to, especially when it comes to identifying ways to solve problems around them and how they could apply strategies taught. As “students only learn to handle complex problems by being exposed to them” (Klertein & Harvey, 2022, p 2).

Another reason, problem solving is important for our Native American students and teachers because it seems that having students learn to problem solve in this day in age is time consuming and most students find it difficult. Teachers find it hard to teach students because they feel that students are not ready but given the right tools teachers can “model good problem solving habits for their students and their questions are designed to help children use a variety of strategies and materials to solve problems” (Klerlein & Harvey, 2022, p 3). As teachers, we try our best to gauge students' learning and understanding through observations, check points, and assessments. However, I feel that we have not taught our students that they should be able to “have a range of strategies they can use to solve problems and understand that there may be more than one (way to get to the) solution” (Klerlein & Harvey, 2022, p 4). Using our Native culture, language, stories, and lifestyle as a tool to understand how problem solving fits in is a skill worth teaching and learning. Teaching our Native students how to think about the problem and how to decipher it with tools can change their outlook on many things, not just in math. Along with this, learning

international strategies that would help them gain better understanding on how to set up problems is a plus if it helps us to gain better understanding. As mentioned in Miracle Math (2006), “Singapore Math students learn a simple technique for solving a variety of math problems” (p 6). I believe that teaching our students this simple tape strategy, as well as, other strategies would help them to visually see what they are doing.

Current School Year

This school year I have 13 students. 4 girls and 9 boys. The students seem to be better in terms of academic standings than compared to the previous year, when we were just getting out of Covid. For Reading, the students are able to recite their alphabet names and sounds. They are able to read simple 3 letter words. Some are able to blend and are able to recall certain digraphs. They are able to read pictures and simple words. The lowest student in my class does not know 4 alphabet letters and sounds. For math, half of the students are able to count from 1 to 120. Then the others are able to at least count up to 50. I have about 2 who need help past 20. They, all students, have an idea on what addition and subtraction is using pictures. However, they all are not familiar with what word problems are. They are able to understand classroom norms and with the new PAX Program that is implemented, students are learning to be more responsible for their behavior and learning.

The PAX Good Behavior Game® (PAX is Latin for peace) gives teachers the tools to help prevent behavioral health concerns and promote positive relationships in schools. It is typically targeted to elementary school children in kindergarten through fifth grade (2021).

Background Knowledge

Some of the ideas on problem solving I want to include in my curriculum unit includes having students learn and understand what a math word problem is. Most students have trouble finding where to start in a math problem after reading the problem. As a teacher, helping students know where to start with prior knowledge would be the first step in learning to problem solve. Though key words are taught to help guide students on where to start, not all problems follow the vocabulary and/or signs they use, especially at higher grade levels. Some problem solving strategies that students could use, and might have prior experience with, include the use of pictures, objects, drawings, sketches, number lines, and other similar modeling approaches (see section on Teaching Strategies for more information on these ideas).

Then the next step would be to teach the students how to problem solve using these strategies, as well as introducing a new strategy. Students would use these basic strategies along with the new strategy, the Singapore Strategy, for how to set up the problems. Here the teacher would again use the drawings and Singapore blocks to help students visualize the problem. For students who are having a hard time grasping the concept they can revert back to what they know. They would also use this visual approach to help them see how the problem is broken down and what parts of the problem look like using the tape drawings.

Getting first grade students to be comfortable with completing word problems is another prerequisite that teachers would need to teach beforehand. Teachers will need to start off by

setting the tone for the classroom environment when it comes to problem solving. Teachers will need to come up with the word problems when first starting. They can either choose a problem from textbooks or support students' cultural connections within the classroom by choosing books that are based upon Native American heritage. Possible cultural stories include Coyote Stories, Navajo Beginning stories, or Stories told about their lifestyle would be a better way of linking reading and math for them. It would also give them a better understanding and visualization of what the word problem is asking of them. The teachers would also come up with open ended questions using these stories to help students understand how word problems are used in everyday life. "The culturally responsive teacher recognizes that potential in every student to engage in mathematical thinking and finds ways to elicit students' mathematical reasoning" (Ellis, 2019, p 10).

Another way that students would become comfortable with word problems is for teachers to read and post word problems on a weekly basis. Creating a positive classroom environment around problem solving would also be a beginning step to teaching students how to learn and understand their skills.

Lastly, students need to attempt to solve addition and subtraction problems given, even if they get it wrong, and be able to explain how they came to the solution strategy and possible solution. Allowing students to be wrong when they have an idea on what the answer might be is the beginning to teaching students how to problem solve. As mentioned, "...it is important to remember that the learning environment supports students' success in mathematics" (Ellis, 2019, p 10). To help students better understand, the teacher can pose culturally related problems such as using livestock, gardening, weaving, or beadwork in word problems for them to solve. Students can use single digit addition/subtraction and up to double digit addition and subtraction up to 100 using Singapore Math tape strategy to enhance my students' learning in how to solve word problems given to them by using tape-like drawing to show the numbers and representation of it. What is Singapore Math?

Singapore math is a type of math used in the country of Singapore. The Singapore math method is a highly effective teaching approach originally developed by Singapore's Ministry of Education in the 1980's for Singapore public schools (What is Singapore Math?, 2022)

The Singapore math method is focused on mastery, which is achieved through intentional sequencing of concepts. Some of the key features of the approach include the CPA (Concrete, Pictorial, Abstract) progression, number bonds, bar modeling, and mental math. Instead of pushing through rote memorization, students learn to think mathematically and rely on the depth of knowledge gained in previous lessons. An attitude that math is important and approachable is also essential. Students perform at a higher level when their potential for understanding and success is assumed. In typical U.S. math programs, students get a worked example, then solve problems that very closely follow that example, repeating all the same steps with different numbers. In Singapore math, students must think through concepts and apply them in new ways from the very start. Since they can't rely on simple replication, students are pushed to greater engagement and broader thinking. Singapore math not only helps students become more successful problem solvers, it helps them gain a sense of confidence and resourcefulness because it insists on conceptual depth. This naturally prepares students to excel in more advanced math. (What is Singapore Math?, 2022, p 23)

In the end, this problem solving unit is for 1st grade teachers on and off the Navajo Reservation. It is for those teachers who work with Native American students and is intended to help them with learning how to use cultural values, ideas, and with teaching problem solving either to Native American students or to get an idea on cultural based math problem solving lessons on problem solving. This unit gives examples of various Navajo Stories, conjoined with questions that lead to problem solving and discussion around it. Then, it also incorporates the Singapore tape strategy to help students problem solve. As we know students who are on the reservation grow up differently than those who are from off the reservation. The examples that I will give in the math word problems will be something they can see and relate to. This unit is also to help those teachers who are non-Navajo get a glimpse of what they need to use in order to make math more relatable to their students. This unit will give examples and tools and terms used to help them understand and relate to what their students go through. For those teachers, who are native, this is an extra tool they can use within their classroom and won't have to run about trying to find the worksheets and the lesson. It would be readily available for them to use. As we know, finding lessons online is difficult and time consuming.

Content Objectives

This unit is going to focus on teaching students addition and subtraction word problems up to 20. It includes various types of culturally related word problems that include adding together, counting on, missing addend and subtraction. Students will read and engage with various types of problems and problem solving strategies. Such a “worthwhile problem gives students the chance to solidify and extend what they know and stimulate mathematical learning” (NCTM, 2000, pg 1). The unit will start with asking students to model problems using manipulatives like gummy bears, cookies, stickers and then move into more abstract representations like counting squares. As students progress from physical manipulatives to counting squares, they will also learn to line up squares in a horizontal linear fashion so that they start developing a sense of a rectangular model, “teachers allow students to engage with multiple representations of mathematical concepts and relationships, comparing and contrasting these as a means to deepen understanding” (Ellis, 2019, p 10). Once they see the rectangular model, a connection to the more abstract tape diagram will be made. In addition to solving problems, the Singapore tape diagram approach can also help students visualize how to write number sentences that represent the word problem.

It is important for our students, as young as 1st grade, to learn and understand word problems in a lot of different ways and through a lot of different problem solving activities. Students need to be able to ask questions, this would be a start for them. As mentioned in the article *Problem Solving Standard* (NCTM, 2000) “students should acquire ways of thinking, habits of persistence and curiosity and confidence in unfamiliar situations that will serve them well outside of the mathematics classroom” (p 1). Having students connect to what they already know and see around their home is a foundation for them to build upon. Since, Native American students and most students in general are more visual, having them see what the end product will look like is a way of problem solving for them, especially at the elementary level. They have to see it. As mentioned by our speaker Paul Long (2022) here at NAU Diné Institute, “Navajo Culture is ingrained with a lot of math, everything from rug weaving, to basket making, to traditional

ceremonies.” These cultural activities are all very visual. Students know what it looks like in the end. Therefore, “the teacher's role in choosing worthwhile problems and mathematical tasks is crucial” (NCTM, 2000, p 2).

Teaching with Navajo language and cultural stories that relate to livestock, Native jewelry, and rug weaving are all ways to incorporate culturally responsive learning. The use of open ended questions, drawings, and lessons on strategies for the students to think about and ponder are all ways to set the stage for students to learn. Having, “higher order questions... support the development of stronger neural connections in the brain” (Leinwand, 2009, p.16). That is to have a “careful progression from literal to inferential to evaluative comprehension” (Leinwand, 2009, p.15) questions that the teacher provides to the students. With that said, the teacher would need to start each week off with a cultural story and discuss what the students understood in the story and how they comprehend what the story is about. “Encouraging support and allowing your students time to think through a problem, (can foster) discussions (that) can be rich” (Nosegbe-Okoka, 2004, p 43). Then, have the students think about a related story problem and what ideas they have in solving it. As mentioned in Accessible Mathematics (2009), “consistent parallels are apparent between the types of questions that require inferential and evaluative comprehension in reading instruction and the probing for ways in which the answers were found in mathematics instruction” (p. 18). This would then move towards questions on how they think to solve it (Problem Posing). The teacher would then add in manipulatives or have students act out the problem for them to gain further understanding of the story problem given. This also “requires the teacher to become more active in the students' learning by playing the role of a facilitator, questionnaire, and listener to students justification” (Nosegbe-Okoka, 2004, p 44). Students would then work individually, then as a small group, eventually presenting their findings as a group.

This unit would take at least 2-3 weeks to complete as opposed to a day or 1 math lesson. Students will need to learn to ask questions, the right ones, be curious, and learn to think about different ways to find the answer to a math word problem. They need to be able to understand that there is more than one way to solve a problem. They also need to learn to be open to other peers' ideas and thoughts, “students are more likely to learn to take responsibility for reflecting on their work and make the adjustments necessary when solving problems” (NCTM, 2000, p 4) if given the opportunity. With that said these are some of the things that this unit would cover and address.

Teaching Strategies

Since this unit will be about 2 to 3 weeks. Teachers with students at younger grade levels should provide various strategies for engaging students with word problems and problem solving skills. This helps them to know there is more than one way to solve a given problem and also helps them to learn to check their work, should they be hesitant in getting the wrong answers. As such, this unit will be built around a variety of strategies to engage students in problem solving. Most of these strategies actually provide students with a lot of ways to model a word problem so that they can find the model that makes most sense to them.

Furthermore, the strategies listed below are ways to help teach students with different abilities and background knowledge. “Emphasizing creativity and novelty in solving mathematical problems” after teaching them how to use strategies learned is one great way to support their learning. (Mikusa, 2022, p 21). A majority focuses on visuals, since this is a first grade level curriculum unit.

Connecting to home - Experiences from home that relate to the problem do help students to see how they can connect to what is being taught. Cultural stories have a way of letting students know that they can relate to problems. Having this in place helps students to see the real world perspective and how they can use it later in life or when they come across it.

Think Pair Share- This strategy is when students are given a problem. They first read the problem, think about it, start to solve it according to their understanding and then get with a partner to share what they know. (This could be assigned or they could randomly choose, teacher option) As they share their thoughts about how to solve the problem and vice versa with their partner, they gain a better understanding of how to solve the problem in a different manner.

Posing Questions- Teacher poses a question and has the students choose their own way to solve the problem. They are not given any strategies to use or are not encouraged to solve it a certain way. The students choose to do things their own way. As they work through the problem they see first hand how their own ideas come about. They also are able to justify their reason for why they did what they did to solve the problem, thus being able to explain it to their partner.

Observation- The teacher observes the students as they work on the problems. The same goes for the students, they observe each other and compare their work.

Manipulatives- This could be modeling how to use classroom blocks, cubes, counters, teddy bears, etc. that students can use to help them visually count and see what they are doing. It helps them to separate the numbers being asked of them in the word problem or gives them an idea on how to work out the problem. Manipulatives are a way for students to show and explain their thoughts and ideas to their partner or the class when they believe they have solved the problem.

Distributed Practice- Students complete one problem a week. The problem is open ended and does require the students to take time to ponder and think about how they could best solve it.

The teacher will use all these various strategies to gauge student learning and to also help students who are not understanding the concepts.

Classroom Activities

The classroom activities will consist of the following:

First and/or Second week: The teacher starts off the week reading a Native American story or folklore and then discussing the story as a class. This will give a better understanding of what the students recall and remember from the story. The teacher will model how to pose questions about the story using Who, What, Where questions. Leading into posing a mathematical question of how many, or how much more or less about the story’s character or pictures they see within the

story. Since the teacher will be modeling how to come up with questions, at the end of the first story, the teacher will ask two to three problem questions posed from the story that students will need to find answers to. Thereafter, students will be given an opportunity to come up with their own questions. Students will answer the questions using their own prior knowledge and begin using manipulatives to help them.

Second and/or Third Week: The teacher will read another story this week. Again, review and discuss the story to clarify understanding and comprehension of the story. Then, the teacher will give students the opportunity to ask questions they have. This does not have to be related to math, but if it does, the teacher will acknowledge the math related question. Just getting the students to ask questions at this time is the key. Students will then use manipulatives to start with, this can include blocks, counters, teddy bears, classroom objects or sorts, and/or drawings to answer one question that was asked. During this time the teacher will not model but observe what the students do.

Third and/or Fourth Week: Teacher will continue with a new story. Again, review and discuss story and comprehension of story. The teacher will then open the floor to students asking questions or coming up with questions about the story. Drawing all math questions to a whiteboard. (Of course some guidance to come up with questions will be required) From here this week, tape diagrams will be introduced. The teacher will model how to use tape diagram strategy. Students will use tape diagram strategy to help them visually see how the problem looks.

Some strategies to have in place prior to student learning about Tape Diagrams are the following:

Scaffolded Problem Solving- is using prior strategies learned from previous lessons. It could also be prior knowledge from real life events that they have been through or know of.

Collaborative Groups- Students will then work in pairs or small groups of 3 to 4 and share their problem solving examples they came up with and then see if it matches with each other in how they thought about the problem. They would use this time to compare ideas and strategies they came up with.

Problem Solving Strategies

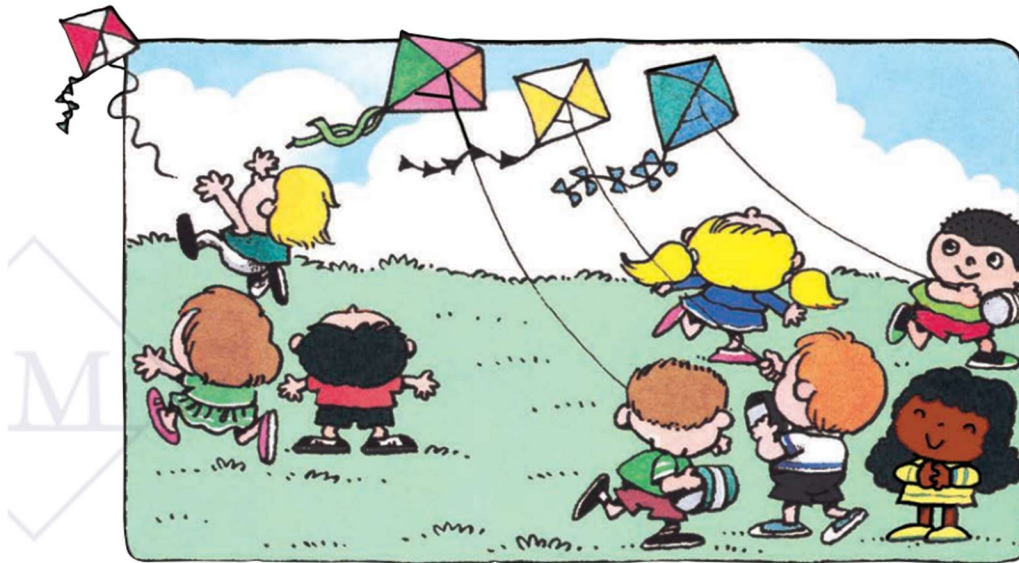
Using Objects - Students using blocks, counters, or beads to help them count is another strategy they can use to help them.

Number lines - This strategy builds upon the Singapore tape diagram model and might need to be taught to students as a more general way of using the tape diagram but in a number line. Students have used the number line in other problems and as part of learning their numbers, so this strategy might help with students who are have difficulty recognizing and counting the numbers. Students using this strategy will also be able to visually see how the number rise and fall and compare to one another on a number line.

Student- Generated Word Problems - Students come up with their own math questions about the pictures given. To complete this strategy, students will just be shown a picture and not be given

any cues or prompts. The students will take time to look at the pictures, think about what they see, and come up with questions that are addition or subtraction related. They will then solve them and show how they got their answer.

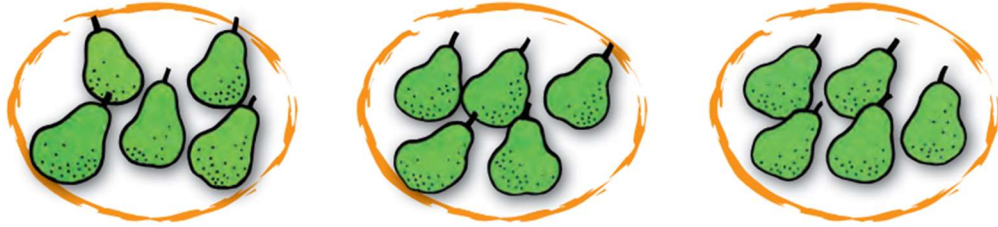
3. Make up as many subtraction stories as you can.
Write a subtraction equation for each story.



Exercises 3, pages 57-59

Using pictures or drawings - Teacher will read the problem or students will read on their own. Then, draw the problem out on a paper as they read each line in the problem. This way the students can see where the numbers are coming from or how to set up the problem according to their understanding. They can explain their thoughts as they do it.

Fill in the missing number.



$$5 + 5 + 5 = \square$$

$$3 \text{ fives} = \square$$

There are 5 pears in each group.



Tape diagrams (Singapore Math) - In this approach, students use the tape diagrams to represent the situation to the word problem. In some situations the tape may represent the whole, but in other situations the tape could be various parts related to a whole. The flexibility of this model has been used successfully with elementary students in Singapore. For this students have to be able to recognize the parts of a whole. Using prior knowledge from manipulatives and drawings does help students to gain better understanding of what the tape represents.

Addition & Subtraction Situations

ADD TO:

Result Unknown	Two bunnies sat on the grass. Three more bunnies hopped there. How many bunnies are on the grass now?	
Change Unknown	Two bunnies were sitting on the grass. Some more bunnies hopped there. Then there were five bunnies. How many bunnies hopped over to the first two?	
Start Unknown	Some bunnies were sitting on the grass. Three more bunnies hopped there. Then there were five bunnies. How many bunnies were on the grass before?	

Assessment Plan

Students' knowledge and understanding of a concept and standards learned is important to see. Knowing where to help your students' learning and understanding level is important to gauge, so you know where to help and guide them. It is also important for students to be able to demonstrate their understanding of how to solve word problems. It would be up to the teacher to assess the students according to what they either use in the school or what they come up with, teacher-made assessment. Below you will find a list of possible assessments that could be used to help gauge students' learning and understanding.

Assessment could include one or more of the following:

- District Formative Assessment (DFA)
- Observations
- Rubrics for craft activities or projects
- Teacher made assessment
- Student presentation
- Completion of worksheets

District Formative Assessment (DFA)- An assessment based upon the standard given in Beyond Textbook. School adopted a curriculum/program. The assessment consists of 5 questions that relate to the standard, students are given the opportunity to explain how they got the answer they came to. For districts using Beyond Textbook, this is a part of the schools assessment criteria to ensure students are learning. A pre and post test is completed on the standard being taught.

Observation- Teacher observes the students' work and how they go about it. The teacher then identifies any areas of concern they see. Then, help the students by guiding them in a way that they come up with the solution using their own thoughts. The teacher also observes the student throughout the lesson to see what they understand the problem to master solving the problem.

Rubrics- Teacher created rubrics to gauge how to master the craft presented to them. Student work would be assessed not only on the solution, but also the problem solving approach and the ability to communicate their work with others (e.g. students, teacher, etc.).

Teacher Made Assessment- Teacher creates their own assessment for students to complete. Assessment could be based on word problems that the teacher creates and puts on the paper, along with students' problem solving strategies, explanations, number sentences, etc.

Student Presentation- Students, working individually or in small groups, present what they have learned. They show it through drawings or diagrams, posters, or models they have created.

Worksheets- Throughout the unit, students will complete problem solving worksheets and show how they got their answers by presenting evidence such as student drawing, work, and crafts and/or presentations.

Alignment with Standards

This unit addressed both Arizona content standards for 1st grade, but Dine Cultural Standards:

AZ Math Content Standard

UW.1.M.A.A.01 Use addition and subtraction within 20 to solve word problems with unknowns in all positions (e.g., by using objects, drawings, and/or equations with a symbol for the unknown number to represent the problem.).

Diné Cultural Standards

Concept 3- Iina PO1 Hooghan nimazi bahane' shil beehozin dooleel- I will recognize the stories of a hogan.

This standard relates to one of the stories that will be read to the students prior to the questions posed to them to work on the unit.

Concept 4- Siihasin PO3 So Diné baa hane'igii baa akonisin dooleel.- I will listen to oral stories about the stars.

This standard relates to one of the stories that will be read to the students prior to the questions posed to them to work on the unit.

Government Standards

Concept 3- Iina PO2 Hane' baa yashti'igii naashchidgo haa nahashne' dooleel. I will use puppetry, acting, and imitation to present information

This standard will be used for students to understand a word problem given to them. The teacher will use voice to read the story and the posed problem to the students.

Resources

Teacher Background Reading

(2010). Why Is Teaching With Problem Solving Important to Student Learning. *National Council of Teachers of Mathematics*.

(2021). *Paxis Good Behavior Game*. Paxis Institute. <https://www.paxis.org/school-based-programming/> This is the site you go to, to learn more about the PAX Good Behavior Program.

Arizona Department of Education. (2016, December). *K-12 Standards Section ELA*. Retrieved from <https://cms.azed.gov/home/GetDocumentFile?id=585aa8a3aadebe12481b8435>. This is where to find the First grade ELA standards for Arizona.

Arizona Department of Education. (2016, December). *K-12 Standards Section Mathematics*. Retrieved from Arizona Department of Education: <https://cms.azed.gov/home/GetDocumentFile?id=58546f14aadebe13008c1a22>. This is where to find the First grade math state standards for Arizona.

Department of Diné Education. (n.d.). *Pre K-3rd Diné Character Building Standards*. Retrieved from Navajo Nation Department of Diné Education: http://www.navajonationdode.org/uploads/FileLinks/0af6457a581b4ac6a25fd65b2c014e7b/K_3DineCharacterBui.expert_8.11.12_2.pdf. This is where to find the first grade Diné standards on character building.

Department of Diné Education. (n.d.). *Pre K-3rd Diné Culture Standards*. Retrieved from Navajo Nation Department of Diné Education: http://www.navajonationdode.org/uploads/FileLinks/0af6457a581b4ac6a25fd65b2c014e7b/Pre_K_3rd_Diné_Culture_Standards_4.pdf. This is where to find the first grade standards on Diné culture.

Ellis, M. (2019). Culturally Responsive Mathematics Teaching. *Ready Classroom Mathematics*, 1-18. www.curriculumassociates.com

Klertein, J., & Hervey, S. (2022). Mathematics as a Complex Problem Solving Activity: Promoting students' thinking through problem solving. *Generation Ready*.

Mikusa, M. G. (1998). Problem Solving Is More Than Solving Problems. *Mathematics Teaching In The Middle School*, 1(1), 20-25.

Nosegbe-Okoka, C. (2004). A Sense-Making Approach to Word Problems. *Mathematics Teaching in the Middle School*, 10(1), 41-45.