Using Navajo Stick Game to Teaching Place Value

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Author Note:

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Abstract

The subject of this unit is, Tsidil, or using the Navajo Stick Game as a teaching tool to teach place value. In this unit you will learn about the oral history and origin of the Navajo Stick game, Tsidil. Using Tsidil as a platform to teach place value. You will see three activities that will describe how to teach rounding to the nearest tens and the nearest hundreds and, lastly, addition and subtraction within 1,000 fluently. It also has the oral his of Tsidil, showing two different stories to explain the origin of the Navajo Stick game called Tsidil.

Keywords: Place Value, Tens and Hundreds, Addition and Subtraction, Tsidil

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Introduction

Personal experience teaching

I got my undergraduate degree with ASU. I was part of the Diné Teacher Education Program at Diné College in Tsaile, Arizona. This was back when the Diné Teacher Education Program was under Arizona State University. I have been teaching for seventeen years here on the Navajo Nation. Nine of those years I taught at Kayenta Community School, also known as Kayenta Boarding School. That is where I started my teaching career back in August of 2002. I am going on my eighth year teaching at Tonalea School. The last seventeen years I have been teaching I taught from various math programs, all researched-base math programs. I use programs such as Saxon Math, Houghton Mifflin Math, EnVision Math, all claiming to teach one math lesson perday. I often find it hard to teach math sometimes because I feel like it would be worthwhile to stay in one place so that students could understand what was being taught but I had to move on quickly. I love teaching and I love being a teacher. I like to think I am a good teacher. I have seen many types of teachers and colleagues come and go. I have learned from many of them. Overall, though, I would say that I have struggled through the years with teaching math.

Experience teaching math using Ready Common Core Math

Tonalea School purchased the Ready Common Core Math program at the end of the school year 2018/2019. I really had a love hate relationship with this program. I noticed I liked teaching from a direct instruction point of view, the point of view where I am at the front of the promethean board and the students listening as I deliver instruction. It was exceedingly difficult to step outside of the box, shift the way I taught, and to create small group instruction. I find that I am that teacher that studies the teacher edition the night before then takes notes of what worked and what did not work to make improvements to teach. Ready Common Core Math program is based on culturally responsive teaching model. Their idea of culturally responsive teaching is defined as "(CRMT) is premised on creating a learning environment focused on mathematical sense making in which each student feels valued for who they are, for their ways of engaging in mathematical reasoning, and for their contribution to the collective success of those within the classroom community," (Mark, 2019). This past year was exceedingly difficult for me because Ready Math asks teachers to create culturally responsive mathematics teaching environment that reflect four elements:

1. Supporting deeper learning: How to ensure student success with coherent and connected mathematical understanding.

2. Engaging and valuing identities: How to honor students' experiences, communication practices, and communities.

3. Sharing Authority: How to build inclusive, collaborative norms and routines.

4. Applying Mathematics: How to use mathematics to understand and investigate meaningful situations," (Mark, 2019).

This program really takes you outside the box and encourages students that there are many right ways to find your answer. There is not just one way, but how you get the answer is part of the learning process. This way of teaching was extremely difficult for me because I was used to

teaching my students the many steps of how I learned how to add, subtract, multiply, work and solve word problems. I thought if I could teach them step by step instructions on how to do a problem then it will be easier for them to learn and faster for them to gain more knowledge. This really changed with the new curriculum.

Context and Rationale

Community demographic

I live and work in the small community of Tonalea, Arizona (aka To'nahalii). We have two convenient stores, a chapter house, and a Day School. We have about 5,000 registered voters in our community. Our school brings in one hundred eighty students. These students come from surrounding towns like Cow Springs, halfway to Tuba City, halfway to Kaibeto, and halfway to Cross-Roads. We have five bus drivers that travel five different routes everyday picking up and dropping off students to and from school. The nearest community to the west is Tuba City about 21 miles. To the north of Tonalea there is Kaibeto, Arizona about 21 miles. Shonto, Arizona is about 40 miles south east of Tonalea. Tuba City has about 7,000 residents. Tuba City has a hospital, Tuba City Unified School District, Tuba City Boarding School.

We do lose a lot of our community children to other schools in our surrounding communities. We lose our community children to schools like Tuba City Public School and Tuba City Boarding School. We also are losing student enrollment to Kaibeto Boarding School, Shonto Preparatory School, Kayenta Unified School District, and Page Unified School District. The reason we are losing a lot of our students to these other schools is because we do not have elective class such as PE, Art, Computers, Navajo Culture and Language instructors, and science etc.

School demographic

I am a third-grade teacher at Tonalea School in Tonalea, Arizona also known as Red Lake (To'nahalii). Tonalea School is a Bureau Operated School (BIE) through the Bureau of Indian Education. Our school is a K-8 school. Our school has a staff of 32 employees with ten certified teachers with one being the Special Education teacher, three education techs, two education aids, two facility management workers, two custodians, three kitchen staff, three administration staff, which includes our principal, and five bus drivers. We have one hundred eighty students enrolled at our school. Of the one hundred eighty students enrolled at our school twelve of them are in my 3rd grade class. I taught the same students two years in a row. I taught this past year's students in second and third grades.

Like all Bureau operated schools, we are mandated to follow a district calendar, training every other Friday. On the Fridays we are not scheduled for Professional Development days teachers are scheduled for teacher planning days. BIE mandates every bureau operated school to use Common Core Standards for Math, and create teacher made assessments. Tonalea School uses NWEA and PARRC to measure AYP.

Ready Math has been integrated school wide, Kindergarten through 8th grade, after data showed increased growth in SY (2018-2019) in math skills in 6th through 8th grades after using the program for two years. Ready Math has tutorial videos available and additional resources to differentiate instructional for subgroups (e.g. ELL and ESS)

Rationale

Tonalea School's initiative is to educate regardless of learning abilities. We educate all students from age 4 years 6 months of age on to 15 years of age. Assessment data produced from assessments such as PARCC, NWEA-MAP, Edgenuity, DIBELS, WIDA, and psychological evaluations of ESS students assist in guiding instructional pedagogy. The assessments help us differentiate by providing individual instruction for each student based on the student's strength and challenges. The assessments also allow us to scaffold by student proficiency.

According to our data students struggle in Operations and Algebraic thinking, scoring an average of 33%. By grade challenge areas are: K-2 Number and operations (33%), 3rd-5th Operation and Algebraic thinking (33%), and 6th-8th Statistics and Probability. NWEA is an assessment tool that measures how much students have learned. So, in other words, when student take the beginning of the year (BOY) assessment, that's their starting the base line. Then MOY-(middle of year) and EOY-(end of year) measures how much students have increased or decreased. This assessment is a semi-formative assessment compared to the PARCC Assessment, which is a summative assessment is take once in the spring measuring what students know.

According to PARCC data in grades 3rd through 8th grade, math students are strong in major content (solving problems involving volume or prisms, adding, subtracting, multiplying, and dividing with multi digit whole numbers, decimals, and fractions) with 20% as met or exceeds but have a need in modeling and application (solving real world problem solving problems with reasoning) with 65% of students as not met or partially met.

According to the NWEA-MAP data, students are stronger in math but have challenges in ELA. The grade levels that are strongest and weakest fluctuate because students move from grade level to grade level each year.

Math Assessments Scores

The math scores for my 3rd grade students for NWEA-MAP demonstrate an overall performance of 69%. This breaks down into 9 of my students performing below grade level (which is below the 21 percentile of all 3rd graders across the nation); 15% of my students (n=2) are low average in the 21-40 percentile; 15% (n=2) of my students are in the average range of 41-60 percentile; and none of my students scored in the high average 61-80th percentile. Similarly none scored above the 80th percentile.

In the area of Operation and Algebraic thinking, 10 students (77%) falls far below the 21st percentile; 2 students (15%) scored low average between 21st-40th percentile; and 1 student (8%) scored in high average between the 61st-80th percentile.

In the area of Number and Operations, 9 students (69%) are in falls far blow 21st-40th percentile; 2 students (15%) scored low average between 21st-40th percentile; 1 student (8%) scored average between 41-60 percentile; and 1 student (8%) scored in high average between the 61st-80th percentile.

Why The Navajo Stick Game

Because of the need for deep conceptual understanding and application of numbers, quantities, and operations (as demonstrated above in the assessment data), I want to write a unit plan on place value using the Navajo Stick game. This is a unit plan for third grade. The purpose of this unit is to teach place value concepts through the Navajo stick game. This unit will be taught in the second or third quarter in the winter months because the Navajo stick game is played only in the winter season.

It is said that the Navajo stick game (Tsidil) was a game made by changing woman in the first world for women. Tsidil is a women's game but men and women can play this game. It is said that when changing woman went back to the west and took her people with her they became sad. She created this game for them to play.

From the article *Mythology of the Navajo Game Stick-Dice* which was written in the 1940's by David F. Aberle he stated that several Navajo men and women gave him several different story origins on the creation of the Navajo stick game. All these stories agreed that there are three sticks with one side blackened and the other side not colored. The black side represents night and the other side represents day. The sticks represent lightning. "Under pressure CA gave the names: Two of the sticks were zig-zag lightning and one was flash lightning," (Aberle, 1942). There are forty stones in a circle divided by four spaces with ten stones in each space.

During the time this article was written the men and women did not want to give the full details of the story because they felt it was a taboo to tell the story in the summer months. The author of the article states that they did not want their names to be given so he used their initials to identify the person interviewed. These different informants gave different four different versions of the story. All versions were deemed equally correct according to the interviewees, but many commended the first and second stories. The first and full myth related the origin of the game to Changing woman (Aberle, 1942).

The first version, given by a person labeled as WH, is my favorite version. According to WH, the beginning was under the earth and the three sticks were brought up on top of the earth. Changing Woman already understood the game and the twin warriors already existed and that made three of them. Changing Woman was one of the holy people and she was thinking that the Navajo people needed a game to play to keep them occupied and to start living above the earth. She brought the game from the underworld. Changing Woman made the three sticks with the black side representing black sky and rain. The white side abalone shell.

Inside where Changing Woman was making the sticks, she had a big basket, called Abalone Basket. She was working inside a blanket and on top, where it should be covered, she did not have anything. So, she used a black cloud to cover

it with... The rim of the abalone shell is the circle of the small stones (Aberle, 1942).

WH went on to say the holy people made the abalone game inside the abalone basket. The abalone shell showed which way the four directions were: East, South, West, and North. These four directions were the four openings in the rock circle. After Changing Woman made all these things, she covered it with a cloud, and she was ready to play the game. It is said that Changing Woman said these three sticks belong to the women and they could play with them because she is the one that made the sticks.

Sometime later the Holy People decide that there were too many bad Navajo people doing bad thing to each other. So, they decided what Navajo people should not have the sacred items made by Changing Woman. The Holy people...

Took away the cloud and sky blanket or abalone shell basket, or the blacken sticks. The Holy people said they can use sticks instead and they can use small stones in a circle with four openings. They cannot use the cloud covering but they can use any kind of blanket. "When the Navaho first made the game, they use cottonwood sticks. The Holy People told them to. The Holy people believed that if they gave the Navajo people the abalone basket, they would have broken it therefore the whole world would be broken too. So, the Holy people kept the basket and just gave the circle (Aberle, 1942).

Building upon this story, my unit will be a three to four-week unit in which I will cover Navajo history, storytelling, and math. I will be using the Common Core State Standards for Mathematics and the Navajo cultural standards.

I will be using Ready Common Core Mathematic Instruction book as a resource to teach place value content. It will center on unit 2, which addresses Number Operation and Base Ten. As part of the unit, students will create one and two step word problems dealing with place value. I will be concentrating on using place value to round numbers, using place value to add and subtract, and use place value to multiply. Students will create real world stories about the Navajo stick game using place value for addition, subtraction, multiplication, and division.

Students will play the Navajo stick game the way it is supposed to be played with all the rules in place. Students will get used to playing the game first before game is modified to use place values tens, hundreds, and thousands.

We will use expected materials to play the Navajo stick game: three sticks with both sides painted, one side painted black and the other side painted white. These three sticks are used as dice in the game. When the sticks hit the big rock in the center of the playing field, and you get 2 white stick and 1 black stick, for example, it is equal to 1 space. When the sticks hit the big rock in the center of the playing field, and you get 2 black sticks and 1 white stick, it is equal to 3 spaces. When the sticks hit the big rock in the center of the playing field, and you get 3 black sticks, it is equal to 5 spaces. When the sticks hit the big rock in the center of the playing field, and you get 3 white sticks, it is equal to 10 spaces. The sticks represent trees and plants on earth.

The black part of the die stick represents night and the white part of the die stick represents day. You move your place holder that many spaces according to how the sticks fall to the ground.

There are 40 rocks in a circle in groups of 10. The center of the circle represents mother earth the gaps between the rocks represents the rivers in the 3rd world journey of the Navajo People into the fourth world. If a player's stick lands in the river the player must go back to the starting point and start all over again. The crashing of the sticks onto the center rock represents lightening. As I stated, the Navajo Stick Game is played only in the winter season but that may vary on different parts of the Navajo Nation. It is also considered a woman's game but both males and females play this game.

Content/Objectives

In this time of pandemic in our local communities and surrounding local and state agencies in the United States, while most schools in and around Arizona have gone back to some type on in person learning, here on the Navajo Nation we are following the social distancing guidelines set by Navajo Nation government. At this time we are teaching in social distancing mode. We are unable to meet as a whole group for in person learning.

Getting ready for Tsidil game, two weeks prior to the beginning of the lesson, I will write a letter to my students and parents requesting them to start collecting their materials for the game. In the letter I will request them to find 40 small pebbles, a stone 7 to 10 inches in diameter, and three 5 x 3 inches sticks. Paint one side black and the other side white. I will explain in the letter that since we can't be together at school for in person learning. I will request the parents to help guide students in collection materials. This will be the first order of business so that when we state our game they will be ready to learn.

Rules of the Game

The rules of the game goes like this. When Changing Woman created this game she informed her people she would not travel with them to their new home. During this time she created a game call Tsidil. Along with many gifts and instructions she gave to her people as she was getting them ready to leave. She gave them dried meat and seeds for food, corn pollen for prayer offerings, herbs for medicine, and the game Tsidil.

The materials needed for the game include. Three cotton wood sticks about 5 inches long and 3 inches wide. One side is white the other side is black. The white side of the stick represents yikai or dawn and the black flat side of the sticks represent chahalheel, night. These three sticks are called bitlool. Students will tap the center stone four times and let the black and white sticks fall. Students can use Popsicle sticks for as place holders going around the circle. There are a total of 40 stones, representing stars. The stone that's in the center of the circle represents earth. The spaces between each of the ten stones represent the rivers.

The way the sticks land on the ground, and even where they land, determines your next move. If the sticks land 3 white sides you move 10 spaces. If you have two black sides and one white side you move three spaces, two white sides and one black side means you move 2 spaces. Last if you

have three black sides you move 5 spaces. It all sounds easy but here is the tricky part: if your sticks falls on one of the rivers you move back to the previous river space and start back from there

Changing Woman explained that rivers are an important part of mother earth, as represented in the game. The gap between each set of 10 pebbles represent rivers. The river that flows form mother earth to the outer circle where the pebbles divide each other. The east river is called Bika' Tooh, male river, and represents the Rio Grande. The southern river that runs form the center (mother-earth) stone to the outer ten pebbles is called Bit'iis Nineez, long body or the Little Colorado River. The western river that runs from the center (mother-earth) stone to the outer ten pebbles is called Bit'aad Tooh, Female rive, Green River or Colorado River. The last nouthern river that runs from the center (mother-earth) stone to the outer ten pebbles is called Bit'iis Doo ninit'i'i, the body that never ends, or San Juan River.

As I stated earlier, the big stone in the center of the circle of is Shima Nahasdsaan, mother earth represents the home land. As Changing Woman set up the game. The first 10 stones that run from east to south represent yoolgai or white shell. The second 10 stones that run from south to west represent dootl'izhii, or Turquoise. The third ten stones that run from west to north represent diichili, or abalone. The last ten stones that run from north to east represent Baashzhinii, or jet. These 40 stones represent the stars in the sky.

When you get to the north and east river, the last ten pebbles the rules change quite a bit. When you throw your sticks and you get all white sticks it is no longer counted as ten spaces it is counted as one space. The next rule is when you are in the last three moves from home and you get three black sticks which equals to move 5 spaces, you can choose one of two choices: (1) you can move back five spaces or (2) you can choose to move forward to use up your two spaces then gift three spaces to another player. They have to accept and move 3 spaces during your turn. Then when it is their turn they still get a turn. You keep two points and give away three to another player.

The last rule is that when you are in the last two moves and get a white and two black (three moves), you must go back three spaces. You can only reach home with an exact throw. In this story Changing Woman advised her people this game can be played any time of the year. She advised her people as you play this game to always remember her and the holy people because it was the holy people that taught them.

Teaching Strategies

Classroom Rules

Classroom rules are students should be prepared at all times ready to learn. Students should always keep in mind that other students are ready and willing to learn as well. Students need to pay attention to all classroom rules. Students need to follow directions. Students need to know classroom routine and how things are set up in the classroom. Students need to follow teacher que when teacher say give me:1. Stop Looks at Teacher (Eyes on Teacher), 2. Listen to Teacher (Ears are listening), 3. Lips Closes (Mouth is quiet), 4. Body Still (Be still wherever you are),

and 5. Hands Free (Put your Pencil or pen all teaching material down). Students need to be respectful at all times towards classmates and teacher. They also need to follow this rule or expectation Keep hand and feet to yourself, hands are for helping not hurting

Distance Learning - Google Classroom and Google Meet

In this time of pandemic in our local communities and surrounding local and state agencies in the United States, while most schools in and around Arizona have gone back to some type of in person learning. Here on the Navajo Nation we are following the social distancing guidelines set by Navajo Nation government. At this time we are teaching in social distancing mode. We are unable to meet as a whole group students for in person learning at school. Tonalea School is teaching student through distant learning.

I am currently teaching my students through google classroom. I will be setting up my lesson through google classroom and meeting through Google Meet. Our school has purchased Schoology, something similar to google classroom and google meet. I am not wasting my time waiting. I am planning on setting up all my class assignments through google classroom and meeting my students through Google Meet.

Home/School Connection -

I will be writing a letter 2 weeks prior to the start of our unit plan. I will request students to gather their materials for this unit Navajo Stick game to Teach Place Value. I will send a list of things students need to gather. One large rock, 40 small pebbles that can be found near river banks and last, they can use Popsicle sticks for place holders as they play the game. I will also be requesting parent involvement so that children can be guided by their parents.

Classroom Activities

Activity 1

Students will play the game the way it should be played. Day one students and teacher will go over the rules and procedures of the game. Students will play the game according to the rules and procedures. Teacher will make sure that when the students are reaching the last ten stone from north to east students need to understand that the rules change. Teacher will emphasize that when students throw three white sticks it no longer represents move ten spaces and now they represent moving one space. Another rules students must understand is when student get three black sticks it represents five but they have 2 options especially if they have three moves left. Option one they can move five spaces back or option 2 is to gift three of the five spaces to someone else and they use two spaces. And the last rule they must understand is when they are in the last two moves and they get two black sticks and one white stick that represents three spaces. They must move back three spaces.

Students will need to understand the rules of the game thoroughly as we play the first 2 games. They must understand what each manipulatives meaning the tools of the game represent. The stones and they there are forty small stones and the big 7 to 10 diameter stone represents mother

earth. Teacher will draw a diagram explaining what each part of the tools mean before playing the game.



Activity 2

Lesson Activity 2 will be round to the nearest tens and adding and subtracting to the nearest tens. Lesson two activity will be modified according to Math Standard: DOK 1 3.NBT.1- Use place value understanding to round whole numbers to the nearest 10 or 100. Learning Target 1-Define round or rounding in relation to place value. Learning Target 2- Round a whole number to the nearest 10; Round a whole number to the nearest 100. Each stone place will be a ten. Three black sides will represent 50, two black and one white will represent 30, two white and one black will represent 20, and three white will represent 100. When they get to the last 10 stones from north to east this where they will use standard DOK 1 and 2 3.NBT.- Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/ or the relationship between addition and subtraction. Learning Target 1-Know strategies and algorithms for adding and subtracting within 1000 fluently add and subtract within 1000. Teacher will emphasize that when students throw three white sticks it no longer represents move 100 by tens spaces and now they represent moving one space which is a 10. Another rule students must understand is when they get three black sticks it represents five tens but they have 2 options especially if they have three tens moves left. Option one they can move five ten spaces back, which means they have to subtract. Option 2 is to gift three tens of the five tens spaces to someone else and they use two ten spaces. And the last rule they must understand is when they are in the last two tens moves. Last they get two black sticks and one white stick that represents three tens spaces. They must move back three tens spaces which means they subtract three tens spaces.

Activity 3

Lesson Activity 3 will be round to the nearest hundreds and adding and subtracting to the nearest hundreds. Lesson three activity will be modified according to Math Standard: DOK 1 3.NBT.1-Use place value understanding to round whole numbers to the nearest 10 or 100. Learning Target 1- Define round or rounding in relation to place value. Learning Target 2- Round a whole number to the nearest 10; Round a whole number to the nearest 100. Each stone place will be a hundred. Three black sides will represent 500, two black and one white will represent 300, two white and one black will represent 200, and three white will represent 1,000. When they get to the last 1,000 stones from north to east this where they will use standard **DOK** 1 and 2 **3.NBT.-** Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/ or the relationship between addition and subtraction. Learning Target 1- Know strategies and algorithms for adding and subtracting within 1000 fluently add and subtract within 1000. Teacher will emphasize that when students throw three white sticks it no longer represents move 1,000 by tens hundred spaces and now they represent moving one space which is a 100. Another rules students must understand is when students get three black sticks it represents five hundreds but they have 2 options especially if they have three hundreds moves left. Option one they can move five hundreds spaces back, which means they have to subtract. Option 2 is to gift three hundreds of the five hundred spaces to someone else and they use two hundreds spaces. And the last rule they must understand is when they are in the last two hundreds moves. Last they get two black sticks and one white stick that represents three hundreds spaces. They must move back three hundreds spaces which means they subtract three hundreds spaces.

Student Assessment Plan

Teacher-made assessments

The teacher will create teacher-made assessments to check for student understanding. Students will create their own stories for a class book that will be my proof that students created their own place value story. Teacher will check for understanding by observing how well students understand rounding to the nearest tens and hundreds and by adding and subtracting within 1,000.

The teacher will create exit tickets for each day. Students will explain what they have learned and write about what they don't understand.

For end of unit assessment evidence, each group will create a video at the conclusion of the unit that demonstrates their understanding of the Navajo Stick Game and its connection to place value. In the video they need to identify what each part of the materials represent and explain how they are using understand rounding to the nearest tens and hundreds. They can also explain how they are going to add or subtract within 1,000.

Zoom small groups participation

The teacher will create small group instruction over Google meet and Google duo so that teacher can watch and observe students as they play the game with their families. I will set a schedule to conference and give directions and redirect if students are not understanding what they are doing. In non-pandemic mode I would break students up into groups of five. Teacher will walk around the classroom observing and checking for student understanding. Teacher will redirect and reteach students in place value rounding and adding and subtracting with in 1,000.

Alignment with Standards

Common Core Arizona State Standards for Mathematics

DOK 1

3.NBT.1- Use place value understanding to round whole numbers to the nearest 10 or 100.L1-Define round or rounding in relation to place value.

L2- Round a whole number to the nearest 10; Round a whole number to the nearest 100.

DOK 1 and 2

3.NBT.- Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/ or the relationship between addition and subtraction. L1- Know strategies and algorithms for adding and subtracting within 1000 fluently add and subtract within 1000.

Dine Standards

These **Navajo Standards** are going to be use because in the game Tsidil the small stones represent the starts. And also the creation of the game Tsidil is part of our creation stories.

Using Navajo Stick Game to Teach Place Value

Diné Cultural Standard- I will develop an understanding of Diné way of life Concept 4: Siihasin PO3- I will listen to oral stories about the stars

Diné Character Building Standard- I will develop and apply critical thinking to establish relationships with environment Concept 2- Ádáhozdílzin Dooleeł PO1- I will listen and observe cultural teaching

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