

Solving Problems through Problem Solving

Learning Shapes Through Play

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*Play is the highest level of child development.  
It is the spontaneous expression of thought  
And feeling. It is the purest creation of the child's  
Mind as it also a pattern and copy of the  
Natural life hidden in man and in all things.*

-Friedrich Froebel

Nineteenth-century German educator and the originator of kindergarten

## Introduction

This curriculum is student friendly and is based on “geometry through play”. Many studies show that children learn best through play. For example, when a child is playing they are more likely to retain the information than when they are told to draw a triangle and explain how many sides it has. Geometry and spatial relationships are important for children because it helps the child to better understand their place in their environment. Students need to understand the importance of structure in shapes in order to better understand the lines in letters. In addition to “learning through play” research based ideas and using hand on activities, such as using spaghetti sticks, pattern blocks, shape sorters, picture books, and even utilizing Navajo rug design and storytelling. I believe that Navajo students should be able to have a cultural connection with both mainstream education and traditional cultural teachings. Students should be able to understand, recognize, identify, and generalize the use of shapes, patterns, and functions in math and be able to connect it to real world problems. The ability to see shapes in our environment is very important to understand math, specifically geometry because it can lead into problem solving. I believe if we have more students who have a strong formation in geometry they will see the world in a different light. “Earth measuring,” is what Geometry means in Greece.

## Context

Tsaile, Arizona

Tsaile, home of the first tribally controlled community college, Navajo Community College, now known as Diné College. Located in the northern four corners of Arizona on the Navajo Nation, just outside of Canyon de Chelly National Monument. 29 miles east of Chinle, 49 miles northwest of the Nation’s capital (Window Rock). Connected by Navajo Route 64 and Navajo Route 12, at the base of Chuska Mountains and home of Tsaile Lake. Tsaile, Arizona is where I am fortunately able to call my home.

Tsaile is located on the Navajo Nation which is located in the northern four corners of Arizona. Tsaile is 29 miles east of Chinle, just outside the Canyon de Chelly National monument. Tsaile is 49 miles northwest of Window Rock, which is the capital of the Nation. The two main roads into Tsaile are Navajo Route 64 and Navajo Route 12. It is located at the base of the Chuska Mountains and near the Tsaile lake, the start of North Rim of Canyon De Chelly. Tsaile is also the home of the first tribally controlled community college, Diné College, formally named as Navajo Community College. There is one Navajo Headstart, they serve 3- and 4-year old’s. The population is 1,408 according to the 2020 Census data.

## Chinle Unified School District

Chinle Unified School District (CUSD) No. 24 is located in Chinle, AZ. CUSD has seven schools total, Chinle (5 schools), Many Farms (1 school) and Tsaile (1 school) that services the communities of Chinle, Many Farms, Tsaile, Luckachukai, Del Murto, Round Rock, Blackrock, Wheatfields, Nazlini, Cottonwood and Tselani. CUSD services over 3,300 students, which continues to increase annually. We are the largest school district on the Navajo Nation in both student count and geographic area. Ninety-seven percent of the students are Diné (Navajo). School buses travel over 6,000 miles on routes daily, as they pick up and transport students to and from school. There is only one High School within the district, which causes most of the students to travel more than one hour in order to get to and from school. Chinle High School is the largest primarily Native American public high school in the entire United States. On average about two hundred plus students graduate from Chinle High School.

March 2020 to May 2021, our district went online due to the pandemic. In March 2020, students, teachers, and faculty went on Spring Break and were not able to return to the classrooms until two years later. The following school year, August 2021 to May 2022, we were able to return to the classroom following the Navajo Nation Department of Education guidelines and CDC guidelines. They asked all schools on the Nation to come up with reopening plans to service students who want to either continue online or return to the classroom. CUSD added an online school, Hózhó Online Academy, to help service students online. The district chose teachers from across the district who had creatively implemented virtual learning the previous years to become teachers for Hózhó Online Academy. Most of the online teachers had around 50 students in each grade level. As for the in-person classrooms, the ratio was 15-23 students to 1 teacher.

## Tsaile Public School

Tsaile Public School (TPS) is a Pre-Kindergarten to 8<sup>th</sup> grade school which had an enrollment of 365 students for the school year 2021-2022. Due to the pandemic, TPS's enrollment dropped from 500+ students to 365 students. Because of Hózhó Online Academy, TPS had 2 online classrooms with 130 students attending. The kindergarten at TPS consists of 5- to 7-year-olds, separated into two different classrooms. Each classroom with 43 students, as well as 54 students online, including the nine who retained Kindergarten the previous school year. In the in-person classrooms, there was 20 girls and 23 boys total. In November, we had five English Language Learners who were tested using the AZELLA tests.

This school year 2022-2023, our district decided to go back in person at all school sites. We do still have Hózhó Online Academy, however, students have to meet certain guidelines to attend. One requirement is to have successfully completed online school last year, with passing grades. TPS now has 419 students enrolled for August and continues to receive students. We have 3 Kindergarten classes with a total of 45 students, first class has 14 students, second class has 15 students and three class has 16 students. Twenty-two students are boys and twenty-three are girls. Eight were retained from kindergarten last school year. In August, there were two English Language Learners who were tested using AZELLA and are now in the pull-out ELL targeted instruction. We also have two students in Special Education. We continue to receive new students throughout the year.

## **Rationale**

### Background Information

As a Navajo woman raised on the reservation by a Navajo weaver, I was drawn to shapes and color at an early age. My earliest memory is waking up or falling asleep to the sound of my mother batting the weaving comb onto the loom which had lots of strings up and down. Tap, tap, tap, tap, silence, while she pulls the dyed sheep spun wool through the warp (the strings), then tap, tap, tap. She continues for another 2 or 3 inches of the dark solid color, black or dark brown, next comes the strips for about 2 inches. Then she prepares to count the strings, she uses both hands and starts at the end of the loom, slowly picking each strand simultaneously from both end of the loom until she can't hold the strands in her hands any more, she puts a piece of yarn in between the strands she is holding. She starts again, the same process until she gets to the middle of the loom and there she places a different color yarn. She now has the center point and the mid-point to the center. Once she is done adding all the strings she starts to count off again and places longer pieces of yarn in between the warp to mark the size of the design. If it does not appear to be symmetrical on both sides she takes the yarn out and does it again. Sometimes the count can take a day or two days depending on the design and complexity of the design. When she is finally satisfied with her count she starts to weave again. It would take her about two weeks to finish a rug, now it takes her about a month. My mother weaves a cross between Crystal and Wide Ruins style of rug, sometimes Ganado Red and Two Grey Hills upon request. I prefer to weave Two Grey Hills which is boxier shapes.

At the time I did not realize she was using geometry. She would explain how to set up the loom, card the wool, spin the wool into yarn, color the yarn and how to make the different patterns when I asked or when I was watching her. She told stories of how Navajos learned how to weave from Spider Woman. After listening and observing I was expected to understand and remember the art form of weaving and be able to create designs in my head before I attempt to design it. The pattern of shapes and repetition of color and the symmetrical design throughout the rug. The patience and the ability to see the complete design before you even start with the dimension, the color or style of design. When you look at a rug, one might think that is so easy to do but when you have to sit at it and do it, it's quite hard. My mother says, "Remember when you are a weaver you must have good thoughts and prayers because you are producing a special rug". As a teacher, I want to instill the same thoughts in my students, their education is important therefore they need to think of it as they are building a "special object" that they can use over and over again to become productive citizens in society. Many Navajo cultural stories, songs and prayers have 4 layers, 4 colors, 4 sets, 4 sides as a base, from there it goes on to 7, 16, or 24. Many ceremonies have sand painting or offering objects that use shapes and color. The song has a repeating pattern. The repeating shapes or patterns, the growing patterns, symmetrical patterns are all part of geometry. The Navajo rug designs also tell a story of when they were introduced and where they originated from. It tells a story through time.

### Classroom Need

Many students continue to struggle in Math due to being online two years ago especially the kindergarten students. Some parents preferred to keep their child home and not have them attend

online preschool or Headstart the last two years. The support for teaching was hard online, most of the students had very limited to no access to the internet. Yes, the tablets or laptops and/or hotspot were provided to them by Headstart (Navajo Nation run Preschool) or Pre-Kindergarten. Some did not attend because they did not have an adult to help them log into their tablet/laptop or to keep them focused on the presentation of learning. Just being read to or asked to create with paper and scissor. They missed out on preschool learning which emphasizes sharing and cooperating with others beside siblings or cousins at home. Most lacked simple vocabulary and basic number sense and alphabetic knowledge.

Last year went by and some of the online students returned to the classroom but they were behind due to not attending virtual class sessions, not completing online assignments, or not having a parent to supervise them while in their online class and doing homework. It was hard to bridge the gap between the two groups of students: students who started at the beginning of the year in class and other students who transferred from home or online learning throughout the school year. Throughout the year, many teachers at TPS expressed concern for students on-line who returned to in-person being behind academically. This is still true now since many of the parents have returned to work in-person. Our school's preschool only had 8 in-class students and 28 virtual students last year. There were some parents or grandparents who took the role of teacher assistant at home and made sure their students were participating and listening online and completing assignments. The kindergarten students who had support at home learned a whole lot more than the ones with no at-home support.

This school year 2022- 2023, we received these students from the preschool and Head Start along with student who have not been in school. Out of my 16 students that are in my class, two were retained from last year (1 was in person and the other online school), seven either went to Preschool or Head Start, and seven have not ever gone to school. Therefore, 5/7 of my students who did not attend school lack basic Kindergarten skills like writing their first and last name, recognizing letters and sounds, number recognition and rote counting. As expected the in-class preschool students and Head Start students are more prepared for Kindergarten. As a Kindergarten team we are doing a lot of re-teaching and remedial teaching this year for the first couple of months. We are already beginning to see progress. It helps that our class size is small and we can have more intense small remedial help. Some students have gained a lot and others we are making small progress. Once we get most of the students back on the same level with lots of parent help we should be able to get them on level or above so they will be successful in first grade. As usually we are still getting transfers into our school, most are behind in their academic or they have behavior issues. We have to get our parents and guardians on board with our expectation and standards so they can work with them at home to.

## **Content Objectives**

Soon after birth, children learn to problem solve through their perception. A baby learns to discriminate between lines, black and white, hot and cold, far and near. They start to recognize people, that is mom because mom feeds me, mom's hands feel soft or mom sings to me. I do not like uncle, he pinches my cheeks therefore I will cry when he picks me up. Little children learn spatial skills and as they attempt to navigate their surroundings a child learns about space through play. A child is sitting and playing, he claps and smiles as he sorts shapes into the

cubical box. He continues to sort the shapes and has become more confident and quickly sorts the shapes. When asked to put the square in the triangle hole, he shakes his head side to side and says “no”. He was not able to name the shape or explain why it happened but he does know that the shape should be the same as the hole. Then he places the block into the correct hole.

Researcher Ginsburg (2022) states:

Clearly young children can see differences between triangles and rectangles, and between books and balls. They may even know the names triangle and rectangle. But at the same time, they may not be able to analyze the basis for their discriminations. They may have not knowledge about the properties of triangles and rectangles. They may not understand, for example, that a triangle must have three sides, that it is a closed figure, or that both figures are polygons (p. 2).

By teaching them how to identify the names of shapes and orally express how the shapes are the same or different, classify the shapes by attributes and connect them to real life at an early age will help them to better understand their environment. By setting the stage of play learning we have just set the student up for wanting to explore and figure out how things work.

Pierre Van Hiele (1986) believes there are four stages of geometry. He proposed a multilevel model for learning and thinking about geometry. Here are the four levels that are appropriate for elementary mathematics teaching (Souveney, 1994).

1. Recognition. Recognize and name geometric shapes of common objects.
2. Description. Describe common characteristics of geometric shapes.
3. Classification. Group shapes into categories according to common characteristics.
4. Deductive Analysis. Prove conjectures about geometric relationships.

Preschool to 3<sup>rd</sup> grade students need to understand these concepts so deductive analysis in higher education will be easier understood. Learners need to understand that the common geometric shapes are all around not just in pattern blocks, not just in school. Understanding the relationship of space can lead to connecting mathematical concepts using spatial relationship. Being able to understand

Thinking about the first stage of geometry, recognition and naming geometric shapes of common objects is where the academic vocabulary is introduced and must become the language while working with the shapes. Many students may see the different shape but not know the name or the attributes of the shape. As teachers we need to set up the environment so they can engage in creating different shapes and learning the name of each shape. Having a student know that a triangle has three sides or a square has four sides is the start to learning that many different shapes have more sides and not always the same size. They will also learn that not all four sided shape is a square it can be a rectangle, a trapezoid, parallelogram, or rhombus. We need to engage students to become successful problem solvers by allowing students time to struggle with the problem and not step in and give the answer (NCTM 2010) For example, we allow students to learn that all four sided shape is not a square, we must step back, ask why it's not a square, what happens when sides are not the same length? They will use manipulative to learn what the difference is instead of telling them this is a square, this is a rectangle. We can also use attribute block and pattern block so they can physically handle the shapes and see and feel the difference in the shapes. “Problem-solving should underlie all aspects of mathematics teaching in order to

give students the experience of the power of mathematics in the world around them. This method allows students to see problem-solving as a vehicle to construct, evaluate, and refine their theories about mathematics and the theories of others,” (Klerlein & Harvey, 2022, p 2). The need for more hand-on manipulation of shapes will develop a deeper understanding of the why square is a square but rectangle is not a square even when it also has four sides. Once they know the why and how, they can continue to build on how to sort by attributes and characteristics of a shape. The more they understand the more they will become engage and curious about the what it’s about shapes. In this unit students will be given time to explore, create shapes through the use manipulatives like pattern blocks, spaghetti sticks and marshmallows, attribute blocks and geoboards. During their discovery time with the manipulative, they will be encouraged to share their discoveries with their table partners and their whole class by explaining what they make and how they made it. By doing this, they are helping each other better understand their shape and how to justify their thinking. Doing this will help differentiate the learning by hands on, visually seeing, helping their peers so they can understand and be able to justify their own thinking. The understanding of basic shapes is the stepping stone later in life to becoming an architect, graphic designer, engineer or other creative field.

Just like the mind of a weaver, we need to give students time and practice to understand that shapes can moved, flipped, turned or enlarged or shrink but they are still the same shape. A weaver is able to construct her design in her head and is able to construct using yarn and the loom as graph paper. They can design by color, shape or size. Weavers understand how lines intersect to make a corner/vertex. Barbara Teller Ornelas, a Navajo weaver well-known for her Two Grey Hills style weaving, when asked how she designs the patterns in her rugs, respond, “...it’s like sitting inside a puzzle. The rug is symmetrical both horizontally and vertically. A rug is like a Kaleidoscope, you only need to design one quarter of the rug, and then duplicate the pattern” (Arizona State Museum) Time, along with hands-on creation and construction, will allow students to begin seeing the magic in shapes, joining them together to make a Kaleidoscope. Students will be able to not only identify the shape by name but be able to describe the shape. They will be able to orally justify that two squares joined at one side will become a rectangle. By having a good understanding of the basic two dimensional shapes they will continue to build on that knowledge and begin to understand three dimensional shapes and the why behind them. They will also be able to explain the similarities and differences of a two dimensional and three dimensional shape. Therefore, within the classroom setting while the students are doing their hand-on activities, walking around the class listening to each group’s creating and discussion on the shapes they created, just ask them, why, what and how questions teaching strategies, “they are afforded the opportunity to ask students questions to clarify their thinking or to help them to reflect on their thought processes. In addition, this type of teachings allows teachers to regularly evaluate students’ understanding of problem-solving situations and their thinking process,” (Nosegbe-Okoka, 2004, p. 44).

Shapes is not only use in Math but also in literacy and writing. Geometry isn’t usually linked to literacy, but it is in fact a fundamental component in learning how to read. Seeing shape with the letter formation help to learn the letter writing at a faster rate than one who is not able to see the letter shape formation. This is one reason why it’s so important for young children and preschoolers to learn about shapes, says preschool teacher Becky Chapron. “A preschooler who is able to distinguish between shapes is better equipped to notice the differences in shapes of

letters. This helps not only with reading but also with writing,” she explains. Being able to see the angles, curve and position of the shape is a foundation of understanding alphabetical formation.

## **Teaching Strategies**

At the beginning of the unit, an introduction of shapes will be set up through whole group discussion. Our discussion will be to focus on shape identification. The whole group discussion will allow students to name shapes that they know. During the discussion students will define what a shape is, “groups of lines that create a close shape with three or more sides”. We will go a nature walk around school to see what shapes of structure we can find around the campus. After the nature walk we will introduce the vocabulary of shapes. Below you will read more about strategies that will be used to help students solidify their understanding of shapes.

### *1. Just ask them “WHY? WHAT? and HOW DO YOU KNOW?”*

The most important strategy I will use is, just ask them “Why? What? and How do you know?”. This is a strategy you can integrate into all subject areas that promote problem solving skill in your students. Try to avoid asking question that require a one/two-word respond. You can ask, “what shape is this?”, it’s a triangle. Why is it a triangle? Or how do you know it’s a triangle? “It’s a triangle because it has three sides or it has three vertices.” In the beginning your students may take a lot longer to respond but with continued questioning “why”, students will begin to express their thinking with additional attributes and you have just reinforced a language-rich classroom. Remember, 5/6-year-old are not going to respond with detailed information within a week, it might take half a year but it’s worth it. “Such discourse reinforces your commitment to a language-rich classroom. It opens the door to a classroom culture of justifying all answers and to an atmosphere that respects and encourages alternative answers” (Leinwand, 2009, p.70). It also gives the quiet students a chance to listen to the other student’s response and they now have a better understand of the shape and will be more willing to respond to the question. Listening to the other students also builds the students vocabulary and add to their word bank. Slowing but surely they will begin to open up to giving more details when describing a shape or explaining their thinking. They will begin to reflect on their thinking using other students respond and reaffirm their own thinking. It’s no longer my teacher said, now it’s my peer, my friend said. Just remember this strategy is very effective but it takes time to get students to respond with extended response, many students will want to just respond with one, two word answers. Wait time and patience will get you the result along with providing lots of sentence stem for students.

### *2. Manipulatives*

The use of materials is very important. Students will use materials while they explore and learn their shapes. Young students have toys to use to pretend play at home why not provide tools for them to also play at school and learn from it. Children learn best when they discover things for themselves. Researchers have repeatedly found that children’s self-directed discoveries often prove to be better learning experiences than parent-directed activities. Your mission should be to set the learning, then step aside and allow your child’s natural abilities to take over (Conkling, 2001, p. x).



Yes, parents are the first teacher but teachers need to continue to add and allow children to continue to explore as much as is allowed to solidify their learning and understanding in spatial relations. Some of the material we can use are:

- Spaghetti sticks and marshmallows-students will use the spaghetti sticks to construct two-dimensional shapes, integrating academic language of sides and vertex while using the spaghetti sticks as sides and marshmallows as vertex, vertices. It can also be used to construct letters, most of the alphabets have shapes and lines in them. Then you can start three dimensional shapes.
- Pattern Blocks- students will use pattern blocks to identify shapes and sorting them into groups of the same shape, color or size. They can start to use smaller shapes to make bigger shapes. Finally, they can use the blocks to build pictures. They can work individually, in pairs or in groups to construct designs using pattern blocks.
- Attribute Blocks- students will use the attribute blocks to sort by shape, color or size while using the academic language of geometry. They can build smaller shapes into larger shapes using the blocks.
- Colored Square Tiles- students can use colored square tiles to construct different size squares or rectangles. They can sort them by color. Later on when in first grade they can start finding out the area and perimeter of the shape. Again they can work individually, in pairs or in groups to construct squares or rectangles.
- Geoboards- students will use rubber bands and flash cards to make matching shapes on the geoboard. They can continue to build real life shapes using the rubber bands. They can work in pairs or alone to construct designs on geoboards using colored rubber bands. Remember to introduce and review proper use of rubber bands.

### 3. *Flash Cards*

Have students work in pairs and use flash cards to quiz each other on facts they need to recall until they are certain both partners know and can remember them all. This works effectively with sight recognition of shapes, vocabulary terms, attributes, sight words, symbols, grammar, or basic facts. Students will use two dimensional shape flash cards to drill each other. I added flash cards labeled, “it has three sides,” “it has four sides,” “it’s a flat shape,” “it’s a two dimensional shape,”. These cards can be used by the students to read and identify the attribute of the shapes and sort them into shape attributes. During this time, they will also get an opportunity to play memory games with their cards, matching the shape or attribute with other students. Later on when you start to introduce the three dimensional shapes, use the three dimensional shape flash card to drill each other. I will add flash cards labeled, “it is a three dimensional shape,” “it has 6 faces,” “it has 8 vertices,” “it has no face,” “it has 0 vertices.” These cards they can use to sort by attributes. This activity is great for quick pair work to get the students moving.

### 4. *Pictures (Draw It)*

Why draw it? “The simple reality every teacher faces in a class of twenty-five students is that very rarely do more than half of the students process the math being taught, see the math being taught, or feel the math being taught in the same way as the teacher sees it” (Leinwand, S. 2009, p. 21). We must provide frequent opportunities for students to draw their thinking, show and

describe what is drawn. It helps them to visualize shapes and mathematics in general. Visuals help students see the problem in everyday language. The use of a number line while counting, adding or subtracting. Draw the triangle and label the sides and vertices. Draw a picture to explain the story problem. Draw the unit square to show the perimeter or area of a square or rectangle. We need to simple ask more “Can you show us?” and “Can you explain how you saw it?” Throughout time pictures have shown history on cave walls to explained what happens.

#### 5. *Gradual Release of Responsibility (You do, We do, I do)*

For our geometry unit, I will use the reverse gradual release of responsibility. The students will be given time to explore on their own (YOU DO) with the manipulative to create shapes. The teacher will go around the class and ask questions using what, why, or how. Then teacher will call on students (WE DO) to explain their shape and share with the class using the document camera. Students share out their thinking, it’s OK to see it your way and see other student’s way of thinking even if it’s different. Finally, the teacher will share her/his thinking (I do) with the students. Sometimes, it will be sufficient to just do the you do and we do, if the students all show understanding. But if you are not getting the explanations or answers you want then you can explain farther what you want to see.

Above I listed the strategies I will use in most of the activities. These strategies I feel will be the most useful in helping the students understand the importance of geometry. Many will overlap, you can use the manipulatives and just ask why during and activity. Understanding that students are not just playing but they are starting to understand their environment, their learning is connected to their environment and the start of justifying their play into the why learn geometry. You can also use these strategies across the curriculum.

### **Classroom Activities**

This curriculum will be implemented during the first quarter and continue into the second quarter of the school year by scaffolding into other geometry standards. It can be used during any part of the year when Geometry is to be taught within your pacing guide. This unit will be 25 days long following Beyond Textbook pacing guide. This estimation of time of implementation is good. Our math block is 30 minutes daily but we have 7 other standards we need to teach simultaneous during this time. Therefore, some of the activities will be extended into 2 or 4 days, starting off with lots of hand-on activities and getting them to talk will set up the rest of year of building on having discussion and learning to reflect on their thinking and learning to problem solve through their problems.

The first activity sets the tone for everyone to be successful. After a quick introduction of Geometry to the students, stating the objective and why we need to learn it. Students will go on a field trip around the school, mainly playground and be able to search for any pattern of shapes. Our objective for this first activity is, “Do you see any two dimensional shape around you? What shapes do you see?” Students are asked to take a mental picture of any shapes they see during the nature walk around the school. Once we return to the classroom, students will take out their white board and draw 2 things the saw and orally tell the class what they drew using the sentence stem, *I draw a \_\_\_\_\_*. This first activity is a visual, oral and drawing assessment of how much

your students know about shapes. This will help me to determine who needs to be challenged and who needs the teacher table group for more in-depth teaching.

Our second activity will take 2 to 4 days depending on how the students are responding to the questions and creating of the shapes. We will start by using spaghetti sticks and marshmallows. They will be given spaghetti sticks and marshmallows, then they will be asked to create shape. Teacher will walk around the room and ask “What kind to shapes did you make? How do you know it a triangle/rectangle/square? How do you know that? What happens when you move it this way? Is it still a triangle/square/rectangle? One the second day, we will use the white board to draw and label our shapes by name: triangle, rectangle, square, circle, oval, trapezoid, parallelogram, hexagon, octagon, pentagon, heart, star, and crescent (moon). We will make flash cards that we can use with our drill partners. during our morning transition time we will meet with our partner and drill each other as a warm up to the lesson. Towards the 3<sup>rd</sup> and 4<sup>th</sup> day of the lesson, have a partner discussion on a shape the chose to create, they will come up with a shared response to share with the class on the attributes of the shape and how to draw their shape. Continue with the same questioning and creating for another day. Throughout the whole activity enforce the academic language through the use of sentence form for students who are have difficulty phase their thinking.

#### \$2.00 Summary

Two-dollar summary is an activity that can be use across the curriculum. But in Geometry we will tie writing with our attributes of shapes. This activity promotes a focus on writing about the attributes of shapes in short sentences. For Kindergartens, you can start with sentence starts like, I have a \_\_\_\_\_. It has \_\_\_\_\_sides/vertices. It looks like a \_\_\_\_\_.

**You have \$2.00 to spend on writing a summary on the attribute of a shape. Each word will cost \$0.10.**

**How many words will you be able to use?**

*An example: I have a triangle. It has three sides.*

*It is a flat shape. It looks like a pizza.*

First, we discuss how many \$0.10 cents do you need to make \$2.00. We need twenty 20 cents to make \$2.00. Therefore, we need to use 20 words to summary and tell about the attributes of one of the shapes we just discussed or you could just have them draw a shape flash card. We will practice how to write a summary as a whole group first before we have them complete the summary on their own. Share the sentence stem that they could use. Slowly scaffold words related to shapes to their summary. After working on a couple more as a whole group let students chose a shape and have them write the summary Then the can share their summary with a partner.

#### Describe/Create a rug

Throughout the unit, we will read stories about weaving about the Navajo rugs and also weaving of other tribes and nationality. I will also share some of my personal experience as a young weaver and explain the different regional weaving pattern of the Navajo Nation. First we will

study the regional design of rugs and compare similarities and differences in shape by look at the shapes that each rug has. Then we will choose one to draw using similar shapes on paper. Finally, Students will pair up with another student who made the same or similar design to work together to make a poster size rug using their drawing as their guide. What size should we cut the shapes so we get the desired design? How do we place them together so there are not gaps in-between the design? What colors are you going to use to make your rug? Which region design is your rug? This may take a little longer than a week to complete but it has a lot of problem solving team share aspect to it.

### **Student Assessment Plan**

At the end of this geometry unit, students will complete the learning goal that were set in the chart below. First, students will be given a pretest to determine student level of understanding of shapes. Observations and teacher anecdotal notes of students learning will be documented daily and adjustments to be made to insure student's success. Collecting student work samples, observing student responses, interaction within discussion and teacher checklists are ways student will be assessed informally. At the end of this unit, students will share with the class their rug design and be able to explain the shapes that they used. The assessments will be use to see that your students can justify their thinking, understand and concept of two dimensional shapes. They will take a posttest, the district formative assessment (DFA).

#### Pre/Posttest (DFA)

The school has a district-wide formative assessment DFA that we give to our students based on the standards that we teach. The results help us determine who needs enrichment or needs to be retaught the standard. Based on the numbers we are able to group our students into RTE groups. In Kindergarten, most of our standards are 10, 15, 25, 30, or 40 days long. The Geometry standards are 25 days each. The data showed that only 68% of TPS Kindergartens were passing the DFA therefore a need to improve.

#### ***Observation and checklist***

Being observant of your student interaction with other and verbal communication in explaining the attribute will help you to better understand your next steps. Having determined checklist that is handle will also check you on track as to what you want your students to know to be successful.

- Observation can be used as an immediate spot assessment to see if the student is understanding, comprehending and able to explain or justify their thinking. You should have a wide range of justification or lead that to better understanding. It's a good idea to have students name on a sheet to take notes of your observation.
  - During the flash card sort, observe to see that the attitudes match the shape.
  - During spaghetti creation observe how the students construct the shapes.
- Checklist can be used to help you stay on task daily based on the standard objective that your students are learning on specific objective, drawing, construction and vocabulary that you have taught.

#### Written Assessment

Written assessment will be cut and glue worksheet, making a 3d shape, multiple choice, drawing object/shapes, or computer base test. In Kindergarten most written assessment at the beginning of year is strings of letters with few words, you would dictate what the students tell you they are writing. Towards the end of the year, more of the writing will be legible. If it is still a string of letters are they at least the initial sound of the words in sentence.

- During \$2.00 summary, students need to use complete sentence since we have been using the sentence form for our orally discussion.
- Are the students able to sort name to shape while using the flash cards.

### **Alignment with Standards**

This curriculum unit is aligned to Navajo Nation Pre-K to 3<sup>rd</sup> grade standards and the Arizona standard. I have also included the English Language Learner standards since I have some students who are ELL students. The standards are list below:

Navajo Nation Pre-K-3<sup>rd</sup> standards

Standard: I will develop an understanding of the Diné way of life.

Concept 1: Thinking I will acknowledge and value my thoughts and personality.

P.O. 3 I will recognize cultural items and jewelry.

Arizona State Standards

K.M.G.A.02 Correctly name shapes regardless of their orientation or overall size (e.g., circle, triangle, square, rectangle, rhombus, trapezoid, hexagon, cube, cone, cylinder, sphere).

K.M.G.B.04 Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/“corners”) and other attributes (e.g., having sides of equal length).

K.M.G.B.06 Use simple shapes to form composite shapes. For example, "Can you join these two triangles with full sides touching to make a rectangle?"

K.M.G.B.05 Model shapes in the world by building shapes from components (e.g., sticks and clay balls) and drawing shapes.

### ***Arizona English Language Learner Standards***

K.SL.3. Ask and answer questions in order to seek help, get information, or clarify something that is not understood.

K.SL.5 Add drawings or other visual displays to descriptions as desired to provide additional detail.

## Resources

Conkling, W. (2001) *Smart-Wiring your baby's brain*. Harper-Collins.

Ginsburg, H. P. (2022) *What Children Know and Need to Learn about Shape and Space*. DREME TE. Retrieved from <https://prek-math-te.stanford.edu/spatial-relations/what-children-know-and-need-learn-about-shape-and-space>

Klerlain, J. & Hervey, S. (2022) *Mathematics as a complex problem-solving activity: Promoting students thinking through problem solving*. Generation Ready, New York

Leinwand, S. (2009) *Accessible Mathematics, 10 Instructional Shifts That Raise Student Achievement*. Heinemann.

NCTM (2000). *Problem Solving Standard*. From NCTM Standards and Processes for School Mathematics. Reston, VA: Author.

NCTM (2010) *Why is teaching with problem solving important to student learning?* Problem Solving Research Brief

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

Souviney, S. (1994) *Learning to Teach Mathematics*. Unknown.

## Additional Resources

Arizona State Museum. The University of Arizona, *Navajo Weaving at the Arizona State Museum*. <http://www.statemuseum.arizona.edu/exhibits/navajoweave/index.shtml>

blog.planbook.com was first indexed by Google in August 2012  
<https://blog.planbook.com/teaching-geometry/>