



MICRONESIAN SANDDRAWINGS

Included in this chapter:

- ◇ Sand Drawing Activity Sheet with Answer Key

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Part 1: Introduction and History

Through the Ethnomathematics Summer Institute, I personally came to realize that life is a dynamic educational institution in itself. Languages, behaviors, knowledge, skills, and talents are acquired and developed naturally, as one grows. Ubiratan D'Ambrosio illustrated in his book, *Ethnomathematics: Link between Traditions and Modernity*, that “mathematics have developed as a result of the interaction of humans with the environment” (D'Ambrosio, 2001, p. 4). However, as children reach school age, their ways of learning change. They move from the comfort of their home into a confined classroom, and from hands-on learning to abstract learning.

In school, skills are categorized into separate subjects such as language arts, science, social studies, and mathematics. Unfortunately, the name of some subjects carry a psychological stigma leading students to treat them with hostility. From personal experience, mathematics is the most commonly dreaded subject among students. Perhaps adding to the confusion is the shift from the traditional use of tangible objects, a physical representation of the theoretical knowledge, to the more abstract model of mathematics. To ensure that learning transitions to this new model, relevant approaches must also be designed for the classroom. Different theories have been proposed to achieve this. According to Piaget, young children “learn about and understand the world only by physically manipulating objects...” (Slavin, 2006, p. 2). Furthermore, Vygotsky, a human development psychologist, expressed that children develop cognitively through playing (Slavin, 2006, p. 2). Playing motivates children to learn.

Teaching that integrates both aspects of learning will therefore provide an atmosphere for the youngsters to thrive in school. The application of sand drawing, a culturally based activity, will satisfy both purposes in children. They will be motivated by drawing in the sand while counting the number of dots printed. Following their observation of the physical objects, they will then convey the number of dots through prints. This method of teaching should be utilized to achieve higher level of learning. This conforms with what Piaget said about children's learning because according to Piaget, as children grow into preadolescence, they begin to think “abstractly” (Slavin, 2006, p. 2).

History

Sand drawing follows the concept of the Euler path and the Euler circuit. This mathematical term was named in honor of Leonhard Euler, a mathematician from Königsberg who solved the seven bridge problem in 1736. The people of his town wondered about the possibility of crossing all the bridges once and ended back up at their home, and he was able to prove that such a route was impossible (Ascher, 1991). The Euler path is represented by a graph that can trace all the different points at one sweep without retracing or interruption. The Euler circuit on the other hand, is defined as a graph that traces back in full circle to the starting point when it is completed.

Sand drawing has a rich history. It has been practiced in different parts of the world for decades with different usages. In central part of Africa in Zaire (Republic of Congo), the Bushoong and the Chokwe tribes both practice this form of art. In Marcia Ascher's book, *Ethnomathematics: A Multicultural View of Mathematical Ideas*, she indicated that sand drawing is a children's game among the Bushoong. This is a subgroup in the Kuba chiefdom that is well known for its decorative work of art (Ascher, 1991). Among the Chokwe, also known as Tshokwe, sand drawing is part of a "storytelling tradition" which is solely done by men (Ascher, 1991). Their figures are called sona. Young Chokwe boys learn to draw during their initiation rite. The more difficult sona is passed down from the expert storyteller to their male descendant (Gerdes, 1999).

On the other side of the world, in the Pacific Ocean, Vanuatu, a group of Pacific islands also practices sand drawing. Like the Chokwe, Nitus, the drawings, are also passed down from generation to the next, and are also performed by men only. Here, however, sand drawing is neither a game nor a storytelling tool, but a "passage to the Land of the Dead" (Ascher, 1991, p. 20). The dead are expected to complete a half-erased drawing guarded by a ghost. If they successfully complete it, they will be accepted, otherwise they will be eaten. Euler is still of central concern. A drawing done in an Euler circuit is known as a suon figure. Similar to the previously mentioned cultures, Vanuatans also construct the dots before the tracing; however, they are not "considered a part of the figure" (Ascher, 1991, p. 20).

On Polowat, an island in the western region of Chuuk State (one of the four states that make up the Federated States of Micronesia) we also practice sand drawing. Little is known of the introduction of the sand drawing to Polowat. Because the Polowatans are recognized to be "seafaring people," it would be safe to assume that they brought sand drawing home from one of their voyages to the other islands (Gladwin, 1970, p. 15). Its continuous use is due to the fact that Polowat is an atoll surrounded by sandy beaches.

Similar to the Bushoong, sand drawing is one of the various challenging games played among the Polowatan children on the beach. Other games of challenges are more physical such as wrestling and cock fighting, but sand drawing is a game to test capabilities of critical performance of complex thinking.



To begin, first, the dots are printed in the sand using the index finger and the thumb.



After the dots are all printed to the challenger's satisfaction, the tracing begins. The index finger, or a stick is used to trace around the dots. Normally a person starts from the upper left corner (because that is how it is first observed) and traces it all the way down diagonally. Then the person turns it upward. Tracing is often drawn diagonally until the end. One may choose any path to take to complete the drawing. The Euler path and Euler circuit are considered.



When all the dots are traced all around without retracing a path, or lifting the finger to continue to the other side, the drawing is considered complete. If one does not meet the requirements, the challenge is not met. The next step provides an illustration of a completed sand drawing.

The final print form a pattern of two different columns in which the first column always has one more than the next column. They can be reprinted as many times as desired. The number of columns and dots printed depends on how challenging the game is, or the level one achieves.

Part 2: Goal of Lesson Plan

This ethnomathematics-based lesson plan implements the use of sand drawings with the hope of bringing an activity into the kindergarten classroom. The lesson plan will apply the cultural richness in the teaching of mathematics. The sand drawing activity will focus on the Counting and Cardinality standard.

- Count to 100 by ones and by tens.
- Count forward beginning from a given number within the known sequence (instead of having to begin at 1).
- Write numbers from 0 to 20.
- Understand the relationship between numbers and quantities; connect counting to cardinality.
- Count to answer “how many?”
- Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.
- Compare two numbers between 1 and 10 presented as written numerals.



Despite various mathematical concepts embedded in the sand drawing, it is not frequently employed in the classroom. Perhaps its lack of usage may arise from the fact that the cultures practicing it are colonized by foreigners who impose their own culture over the indigenous culture. Sand drawing is relevant to local children. It is abundant and all around the island. Its use in the classroom will help children to understand the abstract model of math more clearly.

This lesson encourages complex thinking, one of the General Learning Outcomes of the State of Hawai‘i Department of Education. It also incorporates learning of geometry, colors, and the alphabets.

Part 3: Methodology

To begin, the teacher needs to engage the students’ attention, and motivate them in the lesson. This can be accomplished by playing the sand drawing game. The concepts and objectives of the game need to be explained. Students will be told that in order to win, all the dots should be traced. They should also be told that retracing is not allowed, nor can they lift up their marker to continue and connect the drawing.

Considering that the students are kindergarteners, the activity will start off with one dot then gradually progress to more complex numbers of dots. The teacher will ask for a volunteer to go up to the board and draw one dot and trace around it. The rest of the students will follow along on their own paper. This strategy will also assess



students' prior knowledge of numbers. As each student draws a number of dots, the teacher will know whether or not the student understands the quantity of the numbers orally communicated.

A variety of concepts can be integrated in this particular lesson. After tracing each group of dots, the teacher can incorporate geometry by asking questions about the shape they drew. The teacher may also solidify students' knowledge of the different colors by asking them to color the dots. Alternatively, labeling the dots using the alphabet will strengthen student learning. Color coding or labeling the dots can also help the teacher to easily refer to a specific dot. Constructing, tracing, and counting the dots should be done repeatedly up to whatever amount the teacher decides upon. The Euler path or circuit cannot be achieved with certain sets of dots.

Elaboration and extension of the lesson needs to be planned because of the great learning diversity among the students. A way to elaborate on the lesson is to use manipulatives. Students can construct a structure to represent the dots. To extend the lesson, the teacher may introduce the word form for the numbers. Additional worksheets on this sand drawing lesson are also created to accommodate those who cannot do either the drawing or the use of manipulatives.

Part 4: Conclusion

It is proposed that a lesson based in ethnic culture and a fun activity support a thriving mathematics lesson, and create an opportune place for safe inquiry and exploration. As the students draw, they will discover more of their talents that haven't yet surfaced. Furthermore, this lesson is thoughtfully designed with intentional teaching strategies and fosters all the mathematical domains of the Kindergarten Common Core State Standards in Mathematics. Although it is for kindergarteners, it may be used for higher grade levels such as complex computer programming courses. Sand drawings may be adjusted to accommodate any level of mathematics.

References

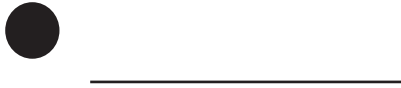
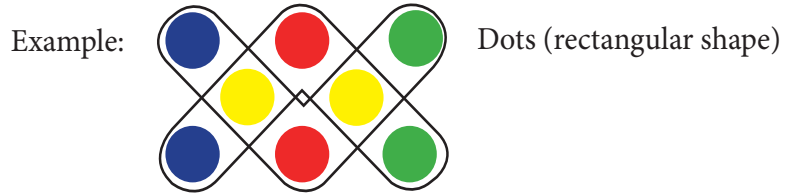
- Ascher, Marcia. (1991). *Ethnomathematics: A multicultural view of mathematical ideas.* (pp.31-62). New York: Chapman & Hall.
- Dean, Jeremy. (2008, July 22). [Web log message]. Retrieved from <http://www.spring.org.uk/2008/07/jean-piagets-four-stage-theory-how.php>
- Gerdes, Paulus. (1999). *Geometry from africa: Mathematic and educational explorations.* (pp. 157-193). Washington: The Mathematical Association of America.
- Gladwin, Thomas. (1970). *East is a big bird: Navigation & logic on Puluwat atoll.* Massachusetts: Cambridge.
- Salvin, Robert, E. (2006). *Educational psychology: Theory and practices.* (8th ed., pp.31-46). New York: Pearson Education.

Sand Drawing Activity Sheet

Name: _____

Date: _____

Directions: Trace around the dots, then write the amount on the blank.



Answer Key

Sand Drawing Activity Sheet

Name: _____

Date: _____

Directions: Trace around the dots, then write the amount on the blank.

