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Early Years

CHROMATIC EXPERIENCES

LEARNING THE SCIENCE OF COLOR

**MUD KITCHENS:
The Joys and
Benefits of Playing
with Mud**

**Teaching Geometry
Through Physical
Activities**

Geo-Baloo: Teaching Geometry Through Physical Activities

By Mi Sun Park, Young Rae Kim, & Eun Hye Kwon

Children learn through play, and playful activities can facilitate learning in all of the content areas. For example, specific activities that are implemented through guided play can support the development of mathematical thinking. With this in mind, we developed a set of activities to teach young learners the definitions and properties of two-dimensional geometric shapes and shared them with our preservice teachers. In particular, we focused on the Geo-Baloo (Geometry + Hullabaloo) activity, which utilizes the principles of the Hullabaloo game.

One of the objectives was to show our students how to facilitate the development of communication skills about geometric definitions and properties (Keiser, 2000). Research studies suggest that body movement can help students develop meaningful understandings of the definitions and properties of mathematical concepts (Alibali & Nathan, 2011; Battista, 2012; Leonard & Bannister, 2018). It also supports improvements in students' problem-solving skills (Alibali & Nathan, 2011; Cone & Cone, 2011). Unfortunately, pupils are often called to memorize them without any corresponding engagement activities (Kobiela, Jackson, Savard, & Shahan 2018).

To enhance student understandings of geometric concepts, we designed activities for learning about two-dimensional geometric shapes. We focused on a quadrilateral, trapezoid, parallelogram, rectangle, rhombus, and square. Each shape is defined as follows: (1) a quadrilateral is a polygon with four sides; (2) a trapezoid is a quadrilateral with exactly one pair of opposite sides parallel; (3) a parallelogram is a quadrilateral with two pairs of opposite sides parallel; (4) a rectangle is a parallelogram with four right angles; (5) a rhombus is a parallelogram with four congruent sides; and (6) a square is a rectangle with four congruent sides or a rhombus with four right angles.

Determining prior knowledge

The initial activities, making shapes together, helps teachers access students' prior knowledge about closed shapes, right angles, parallel lines and congruent segments. During this portion of the lesson, students review geometry vocabulary words by collaborating to form the shapes. Teachers can easily determine comprehension by observing their body movements. During this set of activities, students can work individually, with pairs, or in a group based on the shapes they need to make. First, we had the students stand in a circle. Then, the teacher asked the students to form a shape using their own bodies, with pairs, or in a group. As shown in *Figure 1*, when the teacher asked to make an example of parallel lines, two students stood at a distance and straightened their arms. They tried to make the lines not to touch each other. For making a

closed shape, two students connected their arms without opening. To make a right angle, three students made a vertex and two rays.

After participating in this activity, the students could remember that parallel lines never cross each other and always remain the same distance from each other. They also thought about a closed shape that is totally enclosed by lines. When the students were asked to make a closed shape with congruent sides, they talked about how to make same lengths of each side because they had all different lengths of arms. The activity provided the learners with an opportunity to explore mathematical reasoning.

Definition and properties of polygons

Next, the preservice teachers worked with a partner for a sorting activity. We showed them

Figure 1. Warm Up: Making together



(a) Make a parallel line



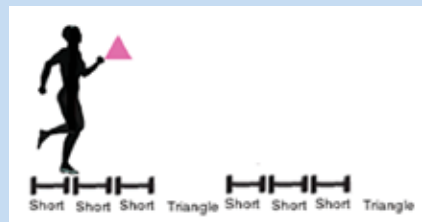
(c) Make a right angle



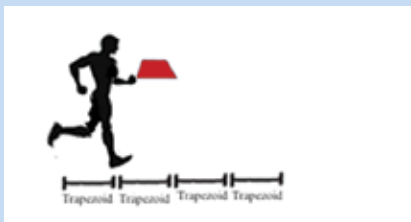
(b) Make closed shapes: A triangle & quadrilateral



Figure 2: Different forms of running with each shape.



(a) Triangles: Run at a very slow pace



(b) Trapezoids: Run in place on the heel of their feet

different types of polygons in the middle of a desk (e.g., triangles, pentagons, and quadrilaterals such as trapezoid, parallelogram, rectangle, rhombus, and square). On the white board, they could see the names of polygons, and we asked them to find a polygon and put it on the correct name. At this time, they should move differently according to the shape. For example, if they found a triangle, they would need to run at a very slow pace, and repeat 'short, short, short, triangle' with a beat. If they found a trapezoid, they would need to run in place on the heel of their feet (see Figure 2). The students would review different PE movements with different shapes while engaging in the sorting activity.

After sorting everything, they discussed how each shape is distinguished from others. Finally, they were asked to create their own examples and definitions of a quadrilateral, trapezoid, parallelogram, rectangle, rhombus, and square. Next, they matched their own definitions of each shape with the teacher supplied definitions.

Geo-Baloo: "Geometry + Hullabaloo"

The Geo-Baloo activity was created utilizing the idea of the Hullabaloo game, which is a high-energy game that involves listening closely and thinking fast as players bounce, twist, spin, high-five, and dance to the music, sounds, and friendly voice of Hullabaloo. In our rendition of the game, we provided mats with quadrilaterals, such as trapezoid, parallelograms, rectangles, rhombuses, and squares and an announcer who broadcast words like the definitions and properties of the shapes and commands of PE movements, such as jumping jack, curl-up, push-up, and squat. The announcer was audio recorded with dance music in the background. The shapes were spread out on the floor randomly (see Figure 3).

For starting one round of Geo-Baloo activity, the teacher turned on the recording. The announcer said things like "move sideways

to a rectangle and do five jumping jacks," or "Put your knee on a rectangle, and touch your elbow to a rectangle with four congruent sides." The students moved around and found the mats having the shapes the announcer's talking about. Finally, the announcer would say something like, "Freeze. Stay on that pad. Is anyone touching the square? If you are, you are the winner. Winner! Do a funky dance!" During this activity, the students would listen for the definitions, properties, or names of different quadrilaterals and think fast as they moved to the correct shapes. We used the definitions from the sorting activity.

Here is an example of one round of Geo-Baloo activity.

Get on a quadrilateral to begin the game. More than one person can stand on one pad.

Are you ready to play Quadrilaterals?

Go to a square.

Move sideways to a rectangle and do 5 jumping jacks.

Run to a shape with 4 right angles and do "Sit and reach" for 5 seconds: one, two, three, four, five.

Fly to a rhombus and do 6 push-ups.

Put your knee on a rectangle and touch your elbow to a rectangle with 4 congruent sides.

Skip to a parallelogram and do 6 push-ups.

Put your toe on a rectangle and touch your heel to a square.

Move backwards to a rectangle and do 5 jumping jacks.

Run to a shape with 4 equal sides and do 5 squats.

Crawl to a quadrilateral with 4 congruent sides and do "Sit and reach" for 8 seconds: one, two, three, four, five, six, seven, eight.

Walk to a parallelogram and do as many curl ups as can.

Stop and jump to a rectangle.

Freeze.

Stay on that pad.

Is anyone touching the square?

If you are, you are the winner. Winner! do a funky dance.

Through engaging in this activity, students would also understand a hierarchy of properties of quadrilaterals. For example, a square is a special rectangle, a special parallelogram, a special trapezoid, and is a special quadrilateral. Classifying quadrilaterals in a hierarchy based on properties is a necessary skill for elementary students to develop in mathematics education (Common Core State Standards Initiative [CCSSI], 2010).

Figure 3: Geo-Baloo Activity



Conclusion

After we implemented the activities, we found that children effectively developed their understanding of the geometric definitions and properties through participating in the body movement activities. Students are able to demonstrate their comprehension of the definitions and properties of two-dimensional geometric shapes through engaging in the activities integrating mathematics into physical education (PE) setting. In particular, the Geo-Baloo activity helped students engage in their learning process of the geometric concepts with a fun game. By actively participating in the set of activities, the students had multiple opportunities to develop their conceptual understanding of quadrilaterals with the definitions and properties. By achieving this understanding, they were also able to classify quadrilaterals in a hierarchy based on the properties. Additionally, they enjoyed the process!

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