



Getting to the Root of the Problem: How to Promote Mathematical Learning in Nature?

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Why Take Math Outside?

- The outdoor environment offers an authentic context for learning and provides opportunities for students to develop important cognitive, personal and emotional skills (Moffet, 2012).
- In order to promote a sense of inquiry and wonder, students need to experience and meaningfully explore their natural environments (JICS, 2011).
- The great outdoors is filled with rich opportunities for math learning that can interest, engage, and promote children's real-life problem solving skills (Pecaski, 2017).
- "Connecting children to nature while growing their math skills will prepare them for a future where they will problem-solve, construct and understand complex relationships needed to guide humanity to a sustainable future" (Ashbrook, 2017).

LEARNING GOALS

- Promote the use of mathematical language (e.g. geometric shapes, symmetry, etc.).
- Encourage data collection and presentation of geometric properties from nature.
- Teach students the importance of having "Math Eyes":
 - A concept that students use to view mathematics in a different lens by understanding that mathematics is not just in school, but in their everyday life and surroundings.

CURRICULUM EXPECTATIONS

Math Strands: Geometry and Spatial Sense

Under the Ontario Math Curriculum expectations, grade two students are expected to:

- Distinguish between the attributes of an object that are geometric properties and the attributes that are not geometric properties, using a variety of tools (p. 47).
- Create and describe symmetrical designs using a variety of tools (p. 48).

** Throughout this hands-on math activity, students will have opportunities to identify the attributes of different objects that they found in nature, and sort them based on its geometric properties.*

Cross-Curricular Connections

Science

- Grade two students are expected to "investigate water in the natural environment" and "assess the impacts of changes in state of solids and liquids on individuals and society" (OME, 2016). This could be combined with math and nature in an examination of students' water consumption and how this impacts our environment.

Literacy

- Grade two students are expected to "write short texts using several simple forms" (OME, 2016). Given the connections between mathematics, science and nature, students could create an informational text to describe their math and/or science findings (e.g. pamphlets, brochures, journal reflections etc.).

Social Studies

- Grade two students are expected to "analyse and construct simple maps as part of their investigations into past and present traditions and celebrations in their local community" (OME, 2016). By providing them with time to explore an area of nature first hand, students can develop their own map of that land to learn the basic elements of mapping.



ENGAGING MATH ACTIVITY

PURPOSE:

The purpose of this activity is for students to explore elements of geometry and spatial sense using objects found in nature. They will identify attributes of their selected objects, and sort them based on its geometric properties. They will also practice using their "Math Eyes", and gain a better understanding of how math can be represented in their everyday life and outdoor surroundings.

1. NATURE WALK:

The students will participate in an outdoor nature walk. During the walk, each pair of students will have the opportunity to observe their surroundings and in a given bag, they will collect ten objects they see that do not hurt or disrupt the land (e.g. leaves, sticks, or pine cones on the ground).

2. DISCUSSION ACTIVITY:

After the nature walk, the students will share what they collected in their bag. This can be done in a circle on the carpet or outside. As the teacher, ask students prompting math questions about their observations:

- What shapes do you see in this object? (e.g. leaf, pine cone, etc.)
- What do you notice? Do any of these objects have lines of symmetry? Are they symmetrical or asymmetrical?

Have a conversation elaborating on the importance of "Math Eyes", and how different geometric properties can be found all around us, in our everyday life and natural surroundings.

3. SORT & GRAPH ACTIVITY:

As a class, come up with a list of observations based on discussed geometric properties. After the discussion, the students will engage in a graphing activity where they will be able to sort the objects they found in nature based on geometric properties that were mentioned. At this time, promote the use of the mathematical language that was taught previously for this unit (e.g. types of geometric shapes, lines of symmetry, etc.).

- In small groups, the students will sort their nature objects based on the geometric properties that they see. Students will be provided with a grid to assist them with sorting and visual organization of their graph.

4. DEBRIEF AND CONSOLIDATE LEARNING:

Students will have the opportunity to present and share their findings from their graphs to the class. Address any questions that students may still be wondering about and debrief the learning goals that students have achieved from this activity.

ACCOMMODATIONS

Supporting ELL learners or students with a wide range of learning needs:

- Use a variety of instructional methods for students to better understand mathematical concepts (e.g. anchor charts, visuals, modify graphs by using grid paper to better support organization, etc.).
- Create ability groupings (e.g. ELL students can be paired with other students that have stronger language skills).
- Incorporate technology (e.g. using Google Translate, photographs, etc.).

Supporting students with physical impairments/limitations:

- Ensure the nature walk pathway is safe and accessible with limited uphill or downhill trails.
- For students that may have limited fine motor skills, provide alternative resources and assistive technologies to support their learning (e.g. using voice recorders to describe their graph findings, provide large tongs or scoops to help pick up items on the nature walk).

RESOURCES

Use books to assist student learning and understanding

- **Sizing Up Winter** By: Lizann Flattt
- **Natural Curiosity** By: Doug Anderson, Julie Comay, Lorraine Chiarotto
- **Sorting through Spring** By: Lizann Flat
- **Swirl by Swirl** By: Joyce Sidman

