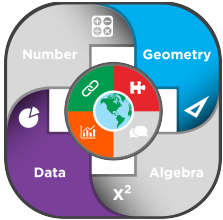


Teach geometry, patterns, measurement, and data analysis using a developmental progression



Understanding what skills and knowledge children already possess is the starting place for instruction. A developmental progression can provide a road map of next steps. To ensure that children have early opportunities to experience a wide range of math content, teachers should use a developmental progression to expose them to geometry and data. Teachers should ensure that children progress through each level of the developmental progression. Helping students build understanding beyond number and operations increases their likelihood of success in later math.

How to carry out the recommendation	Potential roadblocks
<ol style="list-style-type: none">1. Help children recognize, name, and compare shapes, and then teach them to combine and separate shapes.2. Encourage children to look for and identify patterns, and then teach them to extend, correct, and create patterns.3. Promote children’s understanding of measurement by teaching them to make direct comparisons and to use both informal or nonstandard (e.g., the child’s hand or foot) and formal or standard (e.g., a ruler) units and tools.4. Help children collect and organize information, and then teach them to represent that information graphically.	<ol style="list-style-type: none">1. It is challenging enough to cover everything I need to cover in a day without having to think about four more early math content areas.2. Some children are struggling with basic vocabulary skills or are being exposed to English for the first time.



Reference: Frye, D., Baroody, A. J., Burchinal, M., Carver, S. M., Jordan, N. C., & McDowell, J. (2013). *Teaching math to young children* (NCEE 2014-4005). U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance. <https://ies.ed.gov/ncee/wwc/PracticeGuide/18>



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How to carry out the recommendation

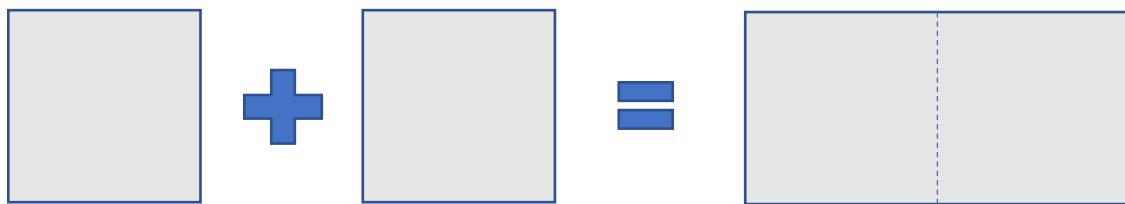
1. Help children recognize, name, and compare shapes, and then teach them to combine and separate shapes.

Teachers should begin by helping children find and name shapes in their own environments. Once children have developed confidence in naming shapes, they should be challenged to name the most important characteristics or “critical attributes” of each shape, using standard vocabulary. For example, a critical attribute of a triangle is that it has three sides. Teachers should also be sure to point out characteristics that are not critical attributes. For instance, teachers should note that all sides of a triangle do not need to have equal length.

To solidify children’s understanding, teachers should provide both examples and nonexamples of shapes. A nonexample is a shape that lacks one or more of the critical characteristics. For a shape activity that highlights critical attributes, see Example 4 on page 29 in the practice guide referenced on the first page of this document.

Once children understand the fundamentals of shapes, teachers should ask them to explore how shapes can be combined and separated. For example, combining two squares can create a rectangle, or cutting a triangle across the middle may make two triangles.

Combining two identical squares will make a rectangle



Note. Taken from Figure 4 on page 28 of the practice guide referenced on the first page of this document.

2. Encourage children to look for and identify patterns, and then teach them to extend, correct, and create patterns.

First, teachers should ask children to experiment with basic repeating patterns, such as having them select a pattern by which everybody in the class will line up to go to lunch (for example, hot lunch, bag lunch, hot lunch, bag lunch, hot lunch, bag lunch). Once students understand simple patterns, they should be challenged to construct more complex ones (for example, hot lunch, hot lunch, bag lunch, hot lunch, hot lunch, bag lunch, hot lunch, hot lunch, bag lunch). Teachers can then challenge children to notice patterns in the classroom, such as tiles on the floor, stripes on clothing, bricks in a wall, or even seasons in the year. Teachers should also introduce errors to children to further challenge their ability to recognize and detect patterns.

After children demonstrate understanding of patterns, teachers should ask them to use their understanding to predict what comes next. Teachers can give children a string of beads that follow a pattern and ask them to continue the pattern along the string.

Teachers can introduce complexity by first asking children to create a pattern based on instructions (two blue beads and then two yellow beads) and then proceeding to introduce new colors or characteristics (small or large beads). Lastly, students should design patterns

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themselves. See Example 5 on page 31 in the practice guide referenced on the first page of this document for a sample activity to create and extend patterns.

3. Promote children's understanding of measurement by teaching them to make direct comparisons and to use both informal or nonstandard (e.g., the child's hand or foot) and formal or standard (e.g., a ruler) units and tools.

Teachers should begin with simple examples to highlight differences in measurement among objects and show how to directly compare them. For example, teachers can present children with two different-sized crayons, ask which one is longer, and then guide them to directly compare the lengths by placing the crayons side by side. Once children demonstrate understanding of direct comparison, teachers can provide them with tasks such as ordering a set of four to five crayons from shortest to longest. Teachers should reinforce measurement vocabulary when making comparisons.

Examples of vocabulary words for types of measurement

Type of Measurement	Examples of Vocabulary Words
Length	Long, longer, longest; short, shorter, shortest
Size	Small, smaller, smallest; big, bigger, biggest
Temperature	Warm, warmer, warmest; cold, colder, coldest
Time	Early, earlier, earliest; late, later, latest
Weight	Heavy, heavier, heaviest; light, lighter, lightest

Note. Adapted from Table 5 on page 32 of the practice guide referenced on the first page of this document.

Next, teachers can challenge students to measure objects using informal or nonstandard units. For example, children can use their hands to measure the length of a piece of paper and express the measurement in numeric units (the paper is three hands long). After experience with informal units, children should be introduced to standard measurement units (inches, feet, ounces, pounds) and use standard measurement tools (rulers and scales) to measure objects. Starting with nonstandard measurement before moving to standard measurement reinforces that nonstandard measurement may give different results while standard measurement does not. Teachers can ask multiple children to measure a length (such as the distance between two desks) using both standard and nonstandard units and compare the results. Standard measurement does not change between children while nonstandard does. Everyday measurements, such as changes in temperatures, time, weight, and height, provide opportunities for children to apply and expand their knowledge.

4. Help children collect and organize information, and then teach them to represent that information graphically.

Teachers should begin familiarizing children with the concept of grouping and visually representing information by asking children to count and sort tangible objects (for example, blocks, crayons) and abstract concepts (for example, 4-year-olds and 5-year-olds). Teachers should challenge children to identify characteristics that lead to grouping objects or individuals (for example, children with different pets, shape of blocks). Children should recognize all characteristics that differentiate sets (shape, size, color) and then count the number of objects or individuals in each set. The two goals are to identify the characteristics that represent each set and compare the number of items in each set. Next, teachers should ask children to visually represent the information they collect, such as in graphs. Teachers should begin with simple tallies and progress to more complex graphs. For a sample activity for teachers, see Example 6 on page 34 in the practice guide referenced on the first page of this document.

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Potential roadblocks and how to address them

Roadblock	Suggested Approach
<i>It is challenging enough to cover everything I need to cover in a day without having to think about four more early math content areas.</i>	Teachers can cover multiple math areas during one lesson. For example, they can ask children to find a collection of objects, count the items, and arrange them in a pattern, all in one lesson. Math games that can be played during transitions or down time, such as “I spy,” can help teachers find time for math learning.
<i>Some children are struggling with basic vocabulary skills or are being exposed to English for the first time.</i>	Teachers can use visual representations of vocabulary concepts. Or, when multiple children in a classroom speak the same non-English language, teachers can assist English-speaking children in learning to count in their classmates’ native languages. Songs and fingerplays are also helpful for learning math vocabulary. Having children arrange materials or draw to display answers can also help to overcome the language gap.



For more information on the research evidence and references to support this recommendation, or for more detailed explanation from the What Works Clearinghouse committee who developed this recommendation, please refer to the practice guide cited at the bottom of the first page of this document.