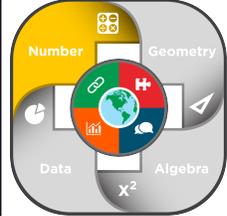


Teach children to view and describe their world mathematically



Teachers can start by having children describe math they see and experience in the real world informally, using their own language. Once children are comfortable with informal representations and talking about math, they can move to more formal representations and vocabulary, with teacher support. Applying math to real-world situations while children play and work at school will help them develop a better understanding of the math concepts they are learning.

How to carry out the recommendation	Potential roadblocks
<ol style="list-style-type: none">1. Encourage children to use informal methods to represent math concepts, processes, and solutions.2. Help children link formal math vocabulary, symbols, and procedures to their informal knowledge or experiences.3. Use open-ended questions to prompt children to apply their math knowledge.4. Encourage children to recognize and talk about math in everyday situations.	<ol style="list-style-type: none">1. I'm not sure what types of open-ended questions are most effective for getting young children to think mathematically.



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>



Recommendation 4: Teach children to view and describe their world mathematically

How to carry out the recommendation

1. Encourage children to use informal methods to represent math concepts, processes, and solutions.

Teachers should begin math instruction by informally representing math concepts through connections to experiences, using recognizable terms and comparisons. For example, teachers should think about the vocabulary that children already know when teaching them addition. Children are likely familiar with the terms “take away” and “left.” Instead of using math terms for subtraction, teachers might say, “Suzy had four candy bars, and her mom took away one candy bar. How many candy bars does Suzy have left?”

Using information representations of math concepts

Concept	Informal Representation	Teaching the Concept
Whole number	“three”	Collections of blocks, dots, tally marks, fingers, or other countable objects can represent numerals. For example, when playing a game, use blocks to represent children’s scores so that everyone can track each player’s score.
Equal	“same number as” or “same as”	Provide opportunities for children to begin to recognize that collections that have the same number when counted are equal. For example, a collection of four plates is the same number as a collection of four cups.
Unequal	“more than” or “fewer than”	Point out that a collection is more (or fewer) than another if it requires a longer (or shorter) count. For example, seven is more than six because it requires counting beyond six.
Addition	“and” or “more”	Start with a collection and add more items to make it larger. For example, start with three crayons and add one more. Then ask, “How many?”
Subtraction	“take away” or “fewer”	Start with a collection and take away some items to make it smaller. For example, start with three crayons and take away one. Then ask, “How many?”

Note. Adapted from Table 6 on page 43 of the practice guide referenced on the first page of this document.

2. Help children link formal math vocabulary, symbols, and procedures to their informal knowledge or experiences.

Once children are comfortable with talking about and representing math concepts informally, teachers can begin introducing formal math concepts. Teachers can do so by connecting informal representations with formal math terms (for example, “more” with “addition”). To help children learn formal terms, teachers should be sure to use each term multiple times throughout the school day and also provide opportunities for children to repeatedly use the term. For example, when teachers read a book with the class, they can make connections to

Recommendation 4: Teach children to view and describe their world mathematically

math terms by talking about the characters in the book, such as one character being younger or older than another.

Children must also learn to connect their informal math knowledge with formal math symbols (for example, “more” connects with +). An example activity might involve having children solve addition or subtraction problems with objects in the classroom. For more ways to connect informal knowledge to formal math symbols, see Table 7 on page 44 of the practice guide referenced on the first page of this document.

3. Use open-ended questions to prompt children to apply their math knowledge.

Teachers can use open-ended questions (“what,” “why,” “how,” and so on) to prompt children to think about math concepts and vocabulary. These questions allow children to apply what they know in answering a question. Open-ended questions should encourage children to use concepts and terms they are familiar with. For example, teachers might show a picture of two trees and ask, “What makes these two trees different?” This question invites multiple answers. One child might say, “The first tree is taller than the second tree.” Another child might say, “They are different kinds of trees.” Allowing for multiple responses lets children discuss concrete objects using math terms. Sample open-ended questions that teachers might use to encourage children to discuss with math concepts are provided below. See the practice guide referenced on the first page of this document for more examples.

Examples of open-ended questions

What makes these the same/different?
How can you tell how ____ (tall, short, long, wide) that is?
How did you figure out how many ____ (blocks, buttons, shapes) there are?
Why do you think this is ____ (taller, shorter, longer, wider) than that?

Note. Adapted from Table 8 on page 45 of the practice guide referenced on the first page of this document.

4. Encourage children to recognize and talk about math in everyday situations.

Teachers can strengthen children’s math knowledge by providing opportunities for them to connect math concepts to the real world. For example, teachers might ask children for help in deciding the number of pencils needed for the classroom: “How should we figure out how many pencils we need for the classroom?” Teachers could then encourage the children to think about the solution path for the problem by discussing it out loud: “How did you think of that answer? What steps did you take?” Once the children have explained how they solved the problem, teachers can repeat the explanation out loud and then ask, “Are there different steps we could have taken to solve this problem?” If children are struggling to discuss their mathematical process, teachers can provide examples. This activity allows students to connect their math knowledge to problem-solving in everyday situations.

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Potential roadblocks and how to address them

Roadblock	Suggested Approach
<i>I'm not sure what types of open-ended questions are most effective for getting young children to think mathematically.</i>	Use the strategies described in this recommendation to think about open-ended questions you might use. Start a math conversation by asking, "How can we figure this out?" Once children have answered, prompt them to think about how they arrived at their answers by asking, "How did you think of that answer?" and, "What steps did you take?" If there is more than one correct strategy, ask children, "Are there other steps we could have taken to solve the problem?"



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.