

Assessment Principles for Early Childhood Mathematics

**Thoughtful observing and questioning can help
you assess children's math skills by Juanita V. Copley, Ph.D.**

How does a teacher assess what young children know about mathematics? How can a child's reasoning or problem-solving skills be assessed? And how can busy teachers do the myriad tasks necessary in working with young children, including organizing an inviting learning environment, planning and carrying out the curriculum, interacting with children to enhance their learning—and still find time to assess the mathematical understanding of each child?

Make Observations

There are no easy answers, but with practice and persistence and by continuing to learn about children's mathematical thinking, teachers can make the process of thoughtful observing and questioning part of their natural routine. To develop these important skills, teachers should plan daily observations that involve watching, listening, and talking with children.

When people hear the word assessment, they often think of testing, but assessment has a much broader meaning. It is the process of observing; gathering evidence about a child's knowledge, behaviors, and dispositions; documenting the work that children do and how they do it; and making inferences from that information for a variety of purposes.

Document, Collect, and Reflect

Assessment should always be designed, carried out, and used in ways that benefit children. With young children, effective assessment includes not just

observing them but documenting and collecting their work. Equally important are the teacher's reflection on and conceptualization of what she has seen and heard. Such thoughtful reflection occurs only when the teacher has an understanding of mathematics and of young children's thinking and learning. A teacher who continually learns from children and about children can become the most effective assessor of the young child's mathematical understanding.

Integrate Assessment

Mathematical assessment should take place before, during, and after instruction. Teachers assess before instruction to plan learning experiences. During the learning experience, the teacher observes and asks questions, listening to children's responses and watching what they do.

If aspects of a child's work or responses indicate a misconception or lack of understanding, the teacher uses this information to make needed adjustments in the curriculum or in her teaching practices to enhance the child's learning and understanding. If assessments show a mathematics program to be ineffective with a number of the children with respect to either their learning or their developing positive dispositions toward math, the teacher may want to consider a new curriculum or new instructional methods. Most important, assessment of mathematical understanding should identify strengths and specific needs of young children.

Assessing children's understanding of mathematics in real, natural settings helps teachers adapt their teaching styles and curricular materials to children's diverse learning styles. Moreover, when assessment becomes a routine part of the ongoing classroom activity, learning is not interrupted.

Question and Listen

Young children are often not proficient in expressing themselves in writing or conversation. This is especially true when children's home language is not English. Teachers must observe their students' actions, behaviors, and interactions and listen carefully to them as they talk. Systematic, planned observations, sometimes with the aid of audio or video recordings, help teachers make valid, objective observations.

Teachers also need to work to develop effective questioning skills and pay careful attention to children's responses. By using these skills in both informal observations and interactions and in conducting systematic, planned assessments, the teacher gets a good picture of each child's understanding and can use the information in planning instruction.

Assessment includes the process of gathering evidence about the mathematics that children know, their ability to use it, and their attitudes toward math. Multiple sources of evidence—samples of children's mathematical work, audio taped descriptions of their problem-solving discussions, anecdotal records describing children's work at centers and on mathematical tasks—should be collected and used on a systematic basis.

Take Multiple Approaches

Teachers must assess their own growth as well as children's in learning mathematics. To evaluate their teaching behaviors and effectiveness, teachers observe, listen, collect, and document children's learning and then use this evidence to consider what is working and what is not.

To assess children's growth in mathematical understanding, teachers observe and document what children can do independently and with assistance. Therefore, assessments must occur systematically over a period of time to fully analyze and assess growth. And because different children show what they know and can do in different ways, assessment should include multiple approaches in order to give a well-rounded picture and allow each child to show his or her strengths.

Assessment in Action

The activity described below provides examples of the assessment process as it occurs in an early childhood classroom.

Observing and Assessing

It is group time, and the children are participating in a weekly activity involving a particular type of reasoning. The gathering provides many assessment opportunities for Mr. Garza, the teacher.

The activity requires children to place their vote in either the YES bag or the NO bag to answer the question of the day. The question of the day—"Do you have a dog?"—is represented in picture form.

Mr. Garza: Let's see (pointing to the ques-

tion of the day). What is our question today? (The YES bag has a picture of a dog, and the NO bag has the same picture with a large X over the dog.)

Children: "Do you have a dog? YES or NO."

Mr. Garza: All right, let's empty the NO bag. (As the teacher empties the NO cubes, he assigns counters.) Hunter, Joanne, and Jorge, you are the counters today. Remember that the three of you must get the same answer before you report back to us.

Hunter, Joanne, and Jorge (returning to report their findings after a quick count): We got five in the NO bag, so five children don't have a dog.

Mr. Garza: OK, now comes the hard question. I wonder how many cubes are in the YES bag. Remember, 20 people voted and there are five NO votes. I wonder how many cubes are in the YES bag. Let's think about it for a while. Remember, good thinkers don't yell out answers; they put them in their heads and think about them.

The teacher observes the ensuing flurry of activity. Some children seem to be counting the children in the class and

trying to eliminate five children. Others use their fingers and ask a friend to help. Still others focus on the calendar board, counting backwards. A few watch everyone else and seem totally confused. Patrick sits quietly, looking confident. Mr. Garza makes notes in a notebook.

Eleana: It's a lot. More than 10 because I counted the five cubes in the NO bag on one hand, and I needed Terry's fingers and mine to count the blue ones.

Federico: It's 22 because I know it.

Silvie: I think it's 16 because I counted on that (points to the calendar).

Tatanne: It's five! (When asked if there were five cubes in both the YES and the NO bags, he responds, "Yeah, I guess so.

Good assessment involves observing and listening, collecting and documenting evidence, and assessing growth.

That way it would be fair!")

Dominique: Can I count the cubes?

Using anecdotal records, Mr. Garza jots down phrases describing some of the children's responses. Patrick understands the part-part-whole relationship of 4, 10, and 15. Eleana has good number sense about the value of the cubes in the YES bag. From his notes, Mr. Garza can plan further experiences that will address individual children's needs as well as continue the weekly YES/NO activity during group time.

In this learning activity, the principles of assessment are evident. Good assessment benefits children and involves observing and listening, collecting and documenting evidence, and assessing growth. Effective assessment enhances instruction, which, in turn, is grounded in a well-designed curriculum. All three sets of principles are essential and intertwined in good educational experiences. ECT

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