CHAPTER 3:

ASSESSMENT

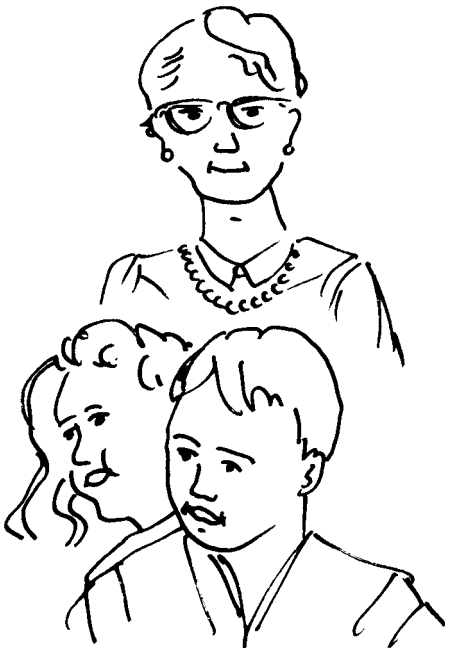
WHY ASSESS?

To Understand How Young Children Think

The focus of any mathematical assessment should be how children process information and not whether answers are right or wrong. For example, sometimes children are able to regroup abstractly while adding and subtracting, because they have memorized the "rules" for borrowing and carrying. But, when they are asked to do a similar problem requiring regrouping skills using beans and cups, it may become apparent through their manipulation of the materials and from their verbal responses that they do not truly understand the process of regrouping.

Administrative Requirements

In this age of accountability, teachers are being pressured by administrators, as well as by the requirements of state and federal projects, to keep detailed records of their class's progress. If teachers can provide documented evidence showing they are meeting the district math goals set for their grade level, school administrators will usually give them the freedom to teach in their style.



Parent Conferences

Assessment records are useful during parent-teacher conferences. A detailed composite sheet (with anecdotal notes) provides specific information about the child for a teacher to share with parents.

Planning Appropriate Activities

Teachers often use assessment information to plan appropriate activities. If one concept appears to be weak throughout the class, then the teacher knows to place more emphasis on that concept at the math stations or in group lessons. The teacher may need to reevaluate how the concept has been introduced and change the approach to meet the class's needs. It may be that the teacher has moved ahead too fast and should repeat earlier experiences to make sure the class moves forward with a more solid understanding of the assessed concepts.

Reassurance

When a teacher works on a daily basis with a class, it may seem sometimes that there has been little growth. Assessments allow the teacher to keep a record of the individual growth that has been achieved by each student throughout the school year.

To Provide Information to the Child's New Teacher

A composite of a child's assessments provides an overview of his or her mathematical understanding to a new teacher — either in the next grade or, if the child moves, at the new school.

Assessment Limitations

A formal assessment can be helpful when a teacher needs information about a child's understanding of specific arithmetic skills. It should be noted, however, that the results of a formal assessment of arithmetic skills demonstrate only what a child knows on a given day in an isolated setting. Some children perform well during a structured assessment, yet, these same children have difficulty in applying these assessed skills in real-life situations. It is important that formal arithmetic assessments be coupled with informal classroom observations and assessments.

Three Assessment Levels

The assessments are grouped into three different levels:

Prenumber Concepts and Skills

The eight prenumber assessments described in this newsletter are: Counting by Rote Memory (in a variety of groupings), One-to-One Correspondence, Conservation of Number, Instant Recognition, Counting Backwards, Estimation of Objects, Numeral Recognition, Numeral Forms. The child should have a clear understanding of the concepts at this level before moving on to number operations. Be sure the classroom environment offers activities and opportunities to naturally develop these skills.

Number Operations

This section assesses the child's understanding of simple addition and subtraction operations at the concept, connecting and symbolic levels. The child's ability to find solutions to simple addition and subtraction problems through visualization is also assessed at this level.

Place Value

This section assesses the child's understanding of the regrouping process. He or she is first asked to build numbers greater than ten using manipulatives at the concept, connecting, and symbolic levels. The child's understanding of regrouping while adding and subtracting is then assessed at the concept, connecting, and symbolic levels.

Assessment Schedule

The teacher should personally assess each child, rather than assigning the duty to someone else. A great deal of insight can be gained during these brief assessing periods about how each child thinks and where breakdowns may occur.

Each child should be formally assessed at the beginning of the school year and before each progress report. Additional assessments should only be performed when the teacher has a specific need for information about a child.

Scheduling Assessment Time

Formal assessments should be done at a time when the teacher is free to focus on an individual child. The teacher can begin to assess at the beginning of the school year after the children have learned the necessary class procedures for sharing, cleaning up and following group rules. Children can be assessed during an easy art activity, recess, and/or lunch time. A classroom aide or volunteer can supervise the class, leaving the teacher free to focus on assessing.

Grade Level Assessment Schedules

The assessments described in this newsletter are used with kindergarten through second grade children. It's up to the teacher to decide which assessments are appropriate for each child.

Keeping in mind that every class (and child) is different, grade level schedules for the initial assessment session are suggested for kindergarten, first grade, and second grade:

Initial Kindergarten Assessments:

Counting by Rote Memory (by one's)
One-to-One Correspondence
Instant Recognition
Numeral Recognition
Conservation of Number

Initial First Grade Assessments:

Counting by Rote Memory (by one's and ten's)
One-to-One Correspondence
Instant Recognition
Numeral Recognition
Conservation of Number
Numeral Writing

Initial Second Grade Assessments:

Counting by Rote Memory (by one's, two's, five's, ten's)
Counting Backwards
Numeral Writing
Number Operations (concept, connecting, and symbolic levels)

If a child has difficulty at the number operations level, then the teacher might go back and assess the other prenumber concepts and skills (e.g., Instant Recognition, One-to-One Correspondence, Conservation of Number, Numeral Recognition) to see if the child has any difficulties. If a child works comfortably at all the number operation levels, then the teacher might begin to assess place value understanding.

The next assessment session:

All grade levels should begin the next formal assessment session by starting with the original assessments. This will enable the teacher to observe each child's individual growth during that period of time. Additional assessments are gradually added as the child progresses.

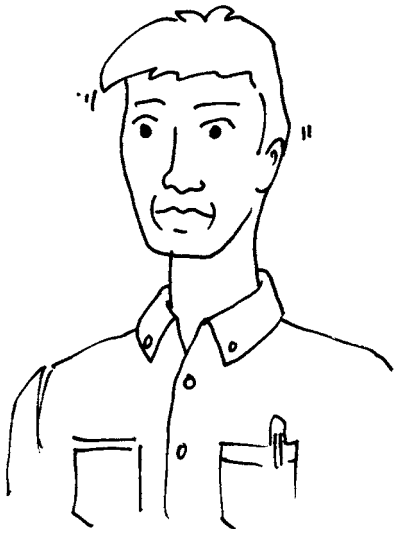
Administering the Assessments

Keep in mind when you formally assess a child, you must act as the facilitator of the assessment. Your role is simply to pose the assessment situation and record the child's actions and responses. Never indicate, either verbally or by body motion, whether a child's answer is correct or incorrect. The child should not be corrected or "taught" during an assessment.

The time it takes to assess a child varies. Some children work quickly, while others take time to answer. Meet with each child several times if necessary. If you try to overassess, the child may not perform to his or her potential. You may wish to complete one assessment with all the children rather than check each child on several skills at one sitting. This "one assessment at a time" procedure may be particularly helpful for teachers who are learning how to administer formal assessments.

It is not necessary to continue repeating an assessment once the child demonstrates that he or she understands a concept and can comfortably apply the concept while working at real-life math activities.

If this is your first experience:



1. Prepare an assessment packet (see Assessment Packet, p. 3.5).

2. Make a file folder for every child with a Student Composite Record stapled to one side. Assessments, observations, and work samples from other subject areas could be included in the file, so all the important information is in one spot when you meet with the child's parents.

3. Read through the assessment descriptions and procedures. Become familiar with the suggested teacher questions and responses.

4. Choose a child you think will be easy to assess.

5. Before meeting with the child, fill in as much of the Student Composite Record as you are able, based upon what you have informally observed.

6. Record the child's responses on the Student Composite Record. Use a different color marker each time you assess. For instance, the first time you assess, you might record the child's responses and the assessment date in blue ink. The next time you assess that child, you might record the assessment date and your observations in red ink. You can see the child's progress by looking at the assessment date and the corresponding responses in the same ink color.

   Anecdotal notes describing the child's actions and verbal responses are very important. Space is provided on the Student Composite Record to record your observations.

7. Now try the rest of the class. Allow yourself several weeks to assess the whole class the first time.

ASSESSMENT PACKET

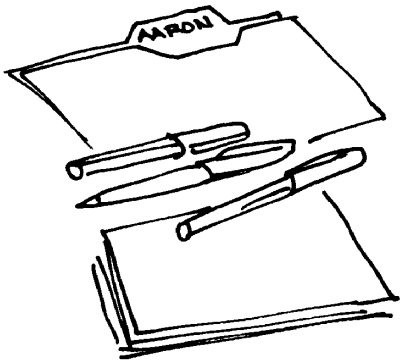
By placing the assessment materials in a zippered plastic bag (or box) and attaching them to a clipboard, you'll be ready to assess at any opportune moment. Just slip in beside a child at work, use the assessment materials to check the desired skill, and then move on to the next child.

Assemble the following assessment items:

❏ Storage container for the assessment material
A large plastic zippered bag or a box (e.g., an old ditto box) and a clipboard work well.

❏ Approximately 100 beans (either pinto, lima, or kidney) stored in a small margarine tub or zippered plastic bag. Beans are a small, inexpensive manipulative. If you choose a different type of object, be sure it is as equally nondescript.

❏ 10 objects with at least one distinctly different attribute (e.g., colored cubes, miniature toys or animals)



❏ File folders (one for each child)

❏ *Student Composite Record,* NL Blackline, #2 (one for each child)
Staple the Composite Record inside the file folder.

❏ Different colored pens (4-5 colors), several pencils.

❏ Numerals written individually on small tagboard cards (0-10 and 11-20). The two groups of numerals should be stored separately. Library card pockets work great.

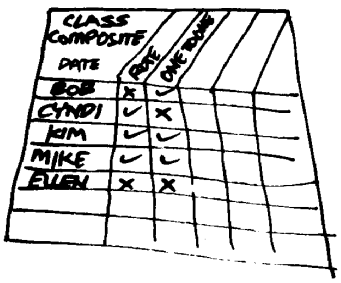
❏ Blank paper (8-1/2" x 11") for numeral writing. (One per child)

❏ Three small identical jars (e.g., baby food jars) with lids labeled A, B, and C. Place 25 beans in the "A" jar, 50 beans in the "B" jar, and 100 beans in the "C" jar.

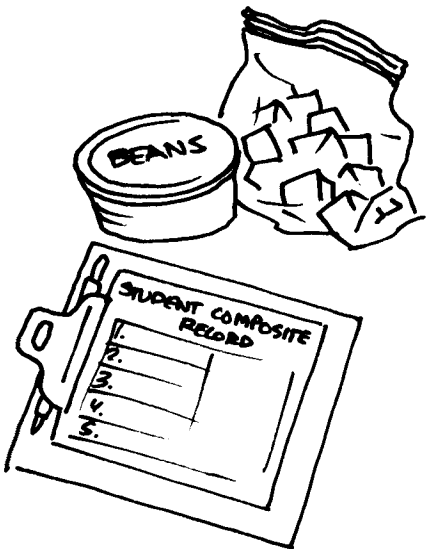
❏ A place value board (*MTW*, p. 364) and 15 portion cups

❏ Teacher Resource Cards

❏ Class Composite Sheets



AFTER ASSESSING THE CLASS



- Review the assessment results. You might find it helpful to compile the individual assessment results into a class assessment record.
- Plan your math sessions (whole class and small group) according to the assessed needs and your informal observations of the children.

It is not necessary to do every activity with each child. Children internalize concepts best when they work in a mathematically rich environment where there are opportunities to use arithmetic skills in context.

Assessment Descriptions

PRENUMBER CONCEPTS

Assessment 1: Counting by Rote Memory

Objective: The child counts verbally using rote memory in different sequences without the use of real objects.

Materials: none

Procedure: Before beginning, it's useful to ask the child how far he or she can count. Then, ask the child to count for you. If the child comfortably counts to 40 and shows that he or she understands the pattern of counting by one's, you might choose to spot check his or her counting to 100. Once the child reaches 100, ask what number comes next. Don't be surprised if you hear the answer 200!

Once the child counts confidently by one's, check whether he or she can count by two's, five's, or ten's.

Assessment 2: One-to-One Correspondence

Objective: The child verbally counts a group of objects correctly while physically or mentally touching each object once, and only once.

Materials: 24 objects

Procedure: Place three groups of objects on the table: a group of 4, 8, and 12. Ask the child to count one of the groups. It's up to the child which group he or she chooses. Continue the assessment according to the child's performance. For instance, if the child counts 12 objects comfortably, then you might ask the child to count all the objects to see if he or she continues to apply the rules of one-to-one correspondence. If the child chooses twelve and has difficulty, then you might ask the child to count a smaller amount to see if he or she continues to have difficulty.

Extension: Check to see if the child can count a group of objects in any order. Begin with five objects with at least one distinctly different attribute. Place the objects in a row on the table. Perhaps the objects are five different colored cubes in the following order: red, blue, green, yellow, orange. (Be sure the child can discriminate between colors.) Ask the child to count the objects. Then ask the child to count the objects again, beginning with a different object (e.g., a blue cube). Next ask the child to count the objects again, this time indicating the last object to be counted (e.g., the green cube). If the child can comfortably count five objects in any order, increase the number of objects.

Suggested questions and commands:
- "Please count the (*cubes*)."
- "Begin with the (*blue cube*) and count all the (*cubes*)."
- "Count the (*cubes*) again. This time count the (*green cube*) last."
- "Can you count the (*cubes*) and make the (*yellow cube*) (*five*)?"

Assessment 3: Instant Recognition

Objective: The child recognizes groups of two, three, four, and five objects instantly without counting the objects.

Materials: 14 objects

The human eye can instantly identify small quantities of objects —usually no more than five or six. Larger numbers of objects are organized into smaller groups. For instance, a child might visually recognize seven objects as two groups — possibly as a group of three and a group of four. Objects in groups larger than ten should be organized into ten's and one's.

Procedure: Place four groups of objects on the table: a group of 2, 3, 4, and 5. Say quickly to the child, "Point to the group of (*three, five, two, three, four, five*)." The child's responses should be instantaneous. Do not allow the child time to verbally or physically count the objects.

Assessment 4: Conservation of Number

Objective: The child understands that the quantity of a group of objects remains constant, even when the objects are rearranged.

Materials: 20 objects

Procedure: Make two horizontal rows of objects (approximately 10). The counters in each row are placed in one-to-one correspondence. Ask the child if there are the same number of beans in each row. If he or she agrees there are, then spread out one line of objects to make a longer line. Now ask the same question, "Are there the same number of objects in each row?" If the child agrees that there are the same number of objects, then the child shows that he or she can "conserve".

Ask the child to explain his or her answer to be sure it's not just a lucky guess. Children who cannot yet conserve are unable to explain the relationship between the two rows of objects. Children show they can conserve through their verbal justification of their response to the question:

"You just spread the beans."
"Because, no beans fell on the floor and you didn't add any. So they're the same."
"They are just spread out. This line is longer, but both lines have the same number of objects."

Assessment 5: Counting Backwards

Objective: The child demonstrates he or she can count backwards comfortably from various starting points.

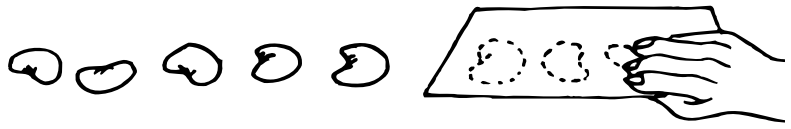
Materials: 20 objects and a piece of paper or cardboard (to cover the beans)

Procedure: Ask the child to place seven objects in a horizontal row. Confirm that there are seven objects in the row. Cover one object and ask the child to tell how many objects there are now. Continue to cover the objects until there are no more. The child counts backwards without counting the objects each time.

Observations: If the child is having difficulty, start over with fewer objects. If the child comfortably counts backwards, repeat the assessment by adding two or three objects to the original group.

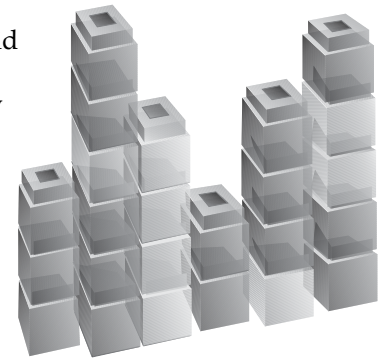
When more objects are added to the line, watch to see if the child finds the new total of objects by counting-on from the original quantity of objects or if he or she starts from the beginning to find the new total. Ask the child how he or she found the total. (You'll be surprised with some of the answers!) Continue as long as the child is confident, but go only as high as twenty.

Extension: Check to see if the child can count backwards by more than one object at a time.



Variation: See *MTW*, p. 113
Materials: 8-10 stacks of Unifix cubes with different numbers of cubes in each stack. Line the stacks up in a row.

Procedure: This assessment checks to see if the child uses counting backwards as a problem solving tool. Place the stacks of Unifix cubes in a row. Point to one stack at a time and ask the child to tell you how many cubes are in each stack. If the child computes silently, ask, "How did you figure that one out?" Note if the child needs to count each stack every time or if he or she finds the total by counting-on or counting backwards from previously counted stacks.



Assessment 6: Estimation of Objects

The child should have had a variety of estimating experiences before attempting this assessment.

Objective: The child verbally estimates objects in several jars. The size of jars and type of objects in the jars are the same, while the number of objects in each jar varies.

Materials: Three identical small jars with different amounts of objects inside them. There should be a pattern to the quantity — e.g., 25, 50, and 100 objects. This allows the child to make reasonable estimates through comparisons and other problem-solving techniques. The jars should be labeled A, B, and C.

Procedure: Ask the child to estimate how many beans there are in jar A. Then say to the child, "If there are (child's estimate) beans in jar A, then how many beans do you think there are in jar B?" And finally say, "If there are (child's estimate) beans in jar B, then how many beans are in jar C?" Allow the child to pick up the jar and look at the beans inside before he or she gives an answer.

Observations: This assessment often gives the teacher some insight into how the child processes information. The closeness of a child's estimate to the correct number of objects is irrelevant. How a child decides on his or her estimate is the key to this assessment. Ask the child to explain how he or she came to the estimate.

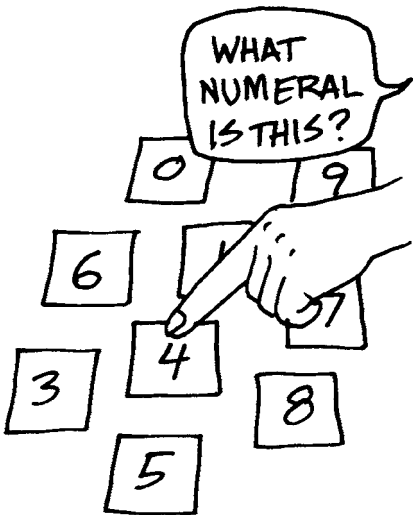
Assessment 7: Numeral Recognition

Objective: The child names the numerals out of sequence from memory.

Materials: numeral cards 0-10 and 11-20

Procedure: Begin with numerals 0-10. Scatter the numerals randomly on the table. Ask the child to point to each numeral card and say its name. If the child comfortably identifies the numerals 0-10, then repeat the process with numerals 11-20.

If the child is reluctant to name the numerals, then encourage a response by asking one of the following questions. Note on *Student Composite Record* the questions used to help the child.



- "What numeral is this?"(as you point to a numeral) This question requires the student to recall the numeral name without any help.

- "Show me…." This question requires less thinking from the child because the teacher names the numeral. (Teacher says: "Show me a four." Child points to the numeral four.)

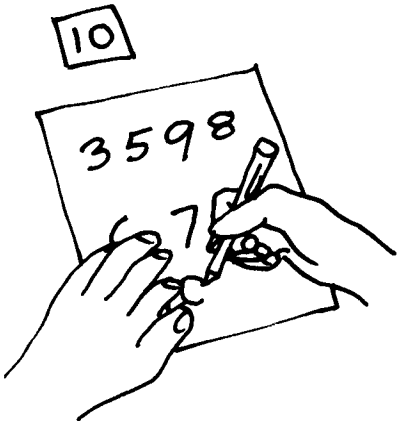
Variation: If the child has difficulty identifying the numerals out of order, place them in order in a row on the table. This method is particularly helpful when working with children who are just learning the numeral names.

Observe the child's eyes and body motions when you say, "Show me a three." Did the child know that three is located at the beginning of the line or did he or she scan the whole line before randomly picking a numeral? When asked: "What is this numeral?", did the child have to begin with one and count to three, touching the numerals each time?

Extension: When the child can comfortably identify the first twenty numerals at random, try larger two-digit and three-digit numbers at random — e.g., 39, 93, 121, 221....

Assessment 8: Numeral Form

This assessment evaluates the child's fine motor abilities. It is not important whether a child can identify the numerals during this assessment.



Objective: The child writes the numerals 0-9 with relaxed and flowing strokes.

Materials: blank paper, pencil, and numeral cards. The numeral cards (0-9) used in the Numeral Recognition assessment can be used for this assessment.

Procedure: Show the numeral cards one at a time, out of order. Ask the child to write the numeral. The child records the numeral on a blank piece of paper. Date the child's work and save it in his or her file folder. It's fun to compare the child's progress throughout the year. It's also rewarding for the child to visually see his or her growth.

Observations: Record your observations as the child writes the numeral. Does the child reverse the form or begin from an incorrect position? Does the child form the numerals with ease, or does it take great effort? Notice the child's pencil grip and position of the paper.

Extension: Ask the child to write numerals from memory. The child writes numerals on a blank sheet of paper. This assessment requires the child to be able to visually recall the numeral and then record the numeral correctly on paper. Observe how the child records the numerals. Did the child write the numerals from left to right, top to bottom, in a circle, or were they scattered randomly? Is the size of the numerals consistent?

NUMBER OPERATIONS

Assessment 9: Simple Addition and Subtraction

Assessment 9a: – Concept Level

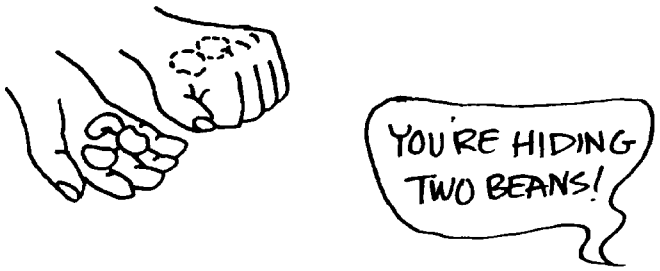
This assessment is sometimes referred to as the "Hand Assessment".

Objective: The child shows knowledge and understanding of the combinations within each number from 3 - 10.

Materials: beans

Procedure: Ask the child to place five objects in your hand. Hide some of the objects in one hand. Show the remaining objects in the open hand and ask the child to tell you how many objects are hiding. The child responds. Repeat this process several times.

Observations: Try six objects if the child responds to the combinations of five objects confidently and with little hesitation. Increase the number of objects until the child's responses begin to slow down. Try a smaller number of objects if the child was hesitant and/or consistently responded incorrectly with five objects. Decrease the number of objects until the child can respond correctly.



Assessment 9b: Connecting Level

Objective: The child shows he or she can read an addition and subtraction equation written on a card and solve it with manipulative materials. The child should experience both vertical and horizontal equations.

Materials: Beans; equation cards

Procedure: Show the child an equation card. Ask the child to use materials to show what the card means. If the child is comfortable doing that, continue by giving the child several more addition and subtraction equations. Be sure the child has an opportunity to solve vertical and horizontal equations while subtracting and adding.

Assessment 9c: Symbolic Level

Objective: The child shows that he or she can record an addition and subtraction equation and solve it with manipulative materials.

Materials: beans; paper; pencil

Procedure: Verbally tell the child an addition equation. Ask the child to record the equation and solve it with manipulatives. Repeat the process with a subtraction equation.

Assessment 9d: Visualization

Objective: The child shows that he or she can visualize addition and subtraction problems and find a solution without using materials.

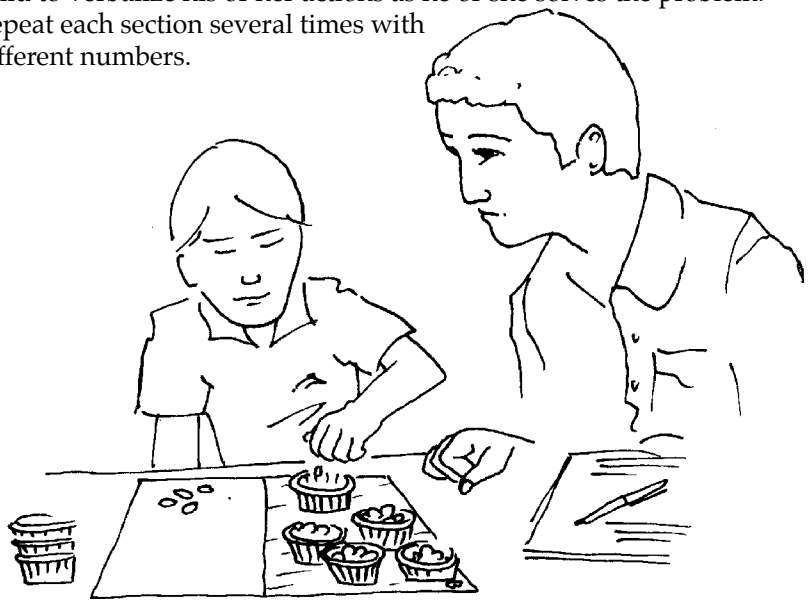
Materials: No materials necessary

Procedure: Tell the child a number story. Ask the child to close his or her eyes and visualize the story in his or her head. The story might be something like:

- "Imagine that you had five gumdrops in your hand. If you gave me three, how many would you have left?"
- "Imagine that you found four shells while walking on the beach. I found two and decided to give them to you. How many do you have altogether?"

PLACE VALUE

Assessment 10 checks to see if the child can build a large number by grouping into hundreds, tens and ones. Assessment 11 checks to see if the child can regroup while adding and subtracting. Both assessments are divided into the concept, connecting and symbolic levels. Ask the child to verbalize his or her actions as he or she solves the problem. Repeat each section several times with different numbers.



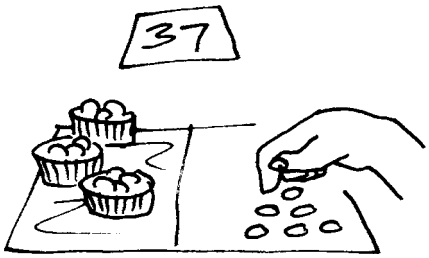
Assessment 10: Building Large Numbers with Manipulatives

10a: Concept Level

Objective: The teacher verbally tells the child a number. The child demonstrates that he or she has an understanding of large numbers by building the number with manipulatives.

Materials: beans, portion cups, place value board

Procedure: Choose a two-digit number. Ask the child to build the number with manipulatives on the place value board.



10b: Connecting Level

Objective: The child demonstrates his or her understanding of a written numeral by building it with manipulatives.

Materials: beans, portion cups, place value board, two-digit and three-digit numeral cards

Procedure: Show the child a two-digit numeral on a card. Ask the child to build the number with manipulatives on the place value board.

10c: Symbolic Level

Objective: The teacher verbally tells the child the number. The child demonstrates that he or she can record a large numeral and build the quantity with manipulatives.

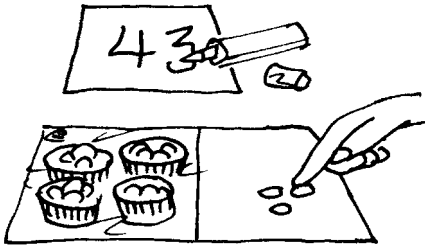
Materials: beans, portion cups, place value board, blank paper and pencil

Procedure: Choose a two-digit number. Ask the child to record the numeral on a blank piece of paper. Then ask the child to build the number with manipulatives on the place value board.

Extensions:

- Once the child shows that he or she is comfortable with two-digit numbers, try three-digit numbers.

- Build a number with manipulatives. Ask the child to verbalize the number. Then ask the child to record the number.



Assessment 11: Regrouping (Addition and Subtraction)

11a: Concept Level

Objective: The teacher verbally tells the child the equation. The child demonstrates that he or she can regroup while adding and subtracting two numbers requiring regrouping.

Materials: beans, portion cups, place value board

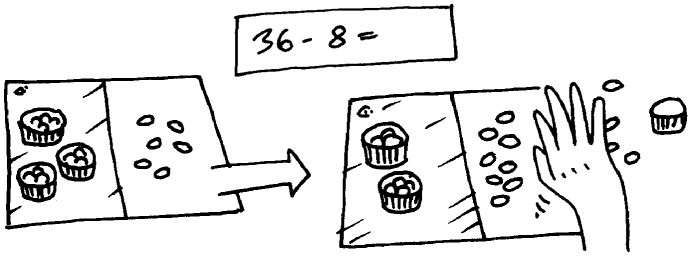
Procedure: Decide on an equation (e.g., 18 + 7= or 26 - 8=) in which the child must regroup. Verbalize the equation as the child manipulates the materials and places them on the place value board. Be sure to present an addition and a subtraction problem.

11b: Connecting Level

Objective: The child shows that he or she can read an addition and subtraction equation sentence which requires regrouping and solves it with manipulative materials.

Materials: beans, portion cups, place value board, equation cards that require the child to regroup

Procedure: Show the child an addition equation which requires regrouping. Ask the child to show you how to solve it with manipulatives and a place value board. Repeat the process with a subtraction equation.



11c: Symbolic Level

Objective: The teacher verbally tells the child the equation. The child demonstrates that he or she can record an addition and subtraction equation requiring regrouping and find the answer with manipulatives.

Materials: Beans, portion cups, place value board, blank paper and a pencil

Procedure: Choose an addition equation which requires regrouping. Ask the child to solve the problem on the paper. Then ask the child to prove the answer with manipulatives and a place value board.