Evaluation

The Evaluation is an assessment tool to find out what the student knows and doesn't know. For example, before a student can write the symbol for a number (numeral), and he must understand the Concept of Number. If a student does not have one-to-one correspondence in counting, the student is not ready to start subtraction.

Do not teach or correct during any test. Record the information to use in planning an appropriate program. Make notes about what the student does and what needs to be learned in future lessons. The information will tell you where to begin instruction. At the end of the test is Basic Mathematics Knowledge required to succeed in *Patterns in Arithmetic: Subtraction - Booklet 1*. In addition, individual lessons list prerequisites.

Summary of Evaluation Tools

Counting - Count out loud as high as you can.
Concept of Number/Cardinality - Teacher hides different amounts of a group of blocks.
One-to-one Correspondence - Count blocks one by one.
Symbolic Concept of Number/Written Number - Write the numeral 3 next to three blocks.
Addition - Teacher writes an addition problem; student proves understanding by building a model.
Subtraction- Teacher writes a subtraction problem; student proves understanding by building a model.

Materials for Evaluation Tools

Copy and use one Evaluation record sheet for each student
Small blocks or beans
Scratch paper
Pencil

Counting - To recite numbers, one by one, in sequence. It is a memorized process. Student counts out loud to 100 if possible.

Ask the student to count as high as she can. Once counting stops, reassure the student if she says she can't count any higher. Tell the student whatever number she counted up to is fine. If the student:
A)   Counts to x and stops. Write down the number. If the student counts to 100 and stops, ask if she knows the next number. She doesn't need to continue counting higher after she has said 101.
B)   Counts to x and mixes up numbers or starts counting numbers out of sequence: Write down the last number she said before she got mixed up. Do not correct the student, just allow her to count as high as she can. See Lessons below.
C)   Misses a number out of sequence but stops herself and makes a correction. Note that she can self correct. If she misses many, she may need more practice with the counting sequence.
D)   Skips the same number in the counting sequence through each series of ten. Make a note about which number is missed and teach to this in a later session.

Lessons: See *Mathematics Their Way*, Chapter 4. Play counting games to one number larger than her mistake. Counting is a memorized sequence. If a student can count to 100, it does not necessarily mean she has an understanding of how much 100 is.

Concept of Number/Cardinality - The quantity a number stands for. It links the number 4 with the amount four.

Materials - Any small manipulative

Ask the student to count three blocks into your hand. You hide one block and ask, **"How many blocks are hiding?"** The student answers "one." Hide a different amount. Be sure to hide all of the blocks and none of the blocks. The student should be able to answer how many are being hidden. If she says the amount that is in the open hand, say, **"Yes, there are x here. How many are hiding in this hand?"** Point to the hand with the hidden blocks. If the student:

A) Confidently says the correct number: Increase the amount of blocks until she is saying the wrong amount. *Do not say,* "Yes, that is right," or "No, that is wrong." Do not show the hidden blocks. Nod and act the same with each guess. Circle the number at which she starts having difficulty.

B) Counts on her fingers. Write down that she can figure out the solution manipulatively only. Record which number she needed to start using manipulatives. See Lesson below.

C) Misses the amount of blocks that are hidden: Write down the number with which she started having difficulty. If three is the number she is working on, open your hand and have her count the blocks again to make sure she remembers how many blocks she started with. Again hide blocks to see if she now understands the task better. If this doesn't work, drop the blocks and ask her to put two blocks in your hand. Have the student count the blocks in your open palm. Then hide one block and ask, **"How many are hiding in the closed hand?"** If she does not say one, end the test. She has very little understanding of numbers. Work on counting activities. See Lesson below.

Lesson: See *Mathematics Their Way*, Chapter 7.

One-to-one Correspondence - Each object is counted one by one. There is a direct link between each object and its numeric name.

Materials - Any counting object such as beans, buttons, blocks, etc.

Put out five blocks. Ask, **"How many blocks are there?"** If the student:

A) Says the number five immediately: Pick up those blocks and put down three blocks. Ask, **"How many now?"** If the correct answer is given, put out four blocks. Then six, then start adding two or three blocks at a time until there are about fourteen blocks OR the student starts miscounting. If there is any hesitancy in the voice, ask her to count them again. Tell her she can touch the blocks if she wants to. Ask, **"Are you sure?"** When she counts the correct amount, have her recount to prove she knows the answer, even when she is correct. Record the highest number she can count correctly.

B) Counts the number of blocks mentally or by touching each one: Pick up those blocks and put down three blocks. Ask, **"How many now?"** If the correct answer is given, put out four blocks. Then six, then start adding two or three blocks at a time until there are about fourteen blocks OR the student starts miscounting. If the student can successfully count this many blocks, this test is complete.

C) Guesses the wrong amount: Have the student count the blocks carefully. Try having the student count objects by touching each object as she counts them. Record that she needs to work on one-to-one correspondence.

D) Counts the wrong amount: Have the student count the blocks carefully. If she can't count them one by one successfully, she needs work on one-to-one correspondence.

Lesson: *Mathematics Their Way*, Chapter 4, Counting; or *Patterns in Arithmetic: Addition - Booklet*

1, Breaking Up Numbers - Three Circles; *Patterns in Arithmetic*: General Math - Booklet 1, Circle Game; and One-to-one Correspondence on the Internet: Interactive STEM, Mathematics in Early Grades: Counting and Cardinality

Symbolic Concept of Number/Written Number

Have the student put out three blocks and write the numeral that goes with that amount. Repeat with a few random numbers up to about twelve. Record the highest number.

Lesson: See *Mathematics Their Way*, Chapter 9.

Say, **"Write the numerals (or numbers) zero to nine."** If the student:
A) Can not write some or any of the numerals: Tell her it is OK if she does not know how to write it. How to write numerals is something she will be learning.
B) Successfully writes the numerals from zero to nine: Look at the form of the numerals, how the pencil is held and how each numeral is made. Record which numerals need just to be practiced more for better penmanship or those that need to be taught how to be formed correctly. For example, are eights made with two circles versus a flowing motion from top to bottom? For fluency and speed, eights are better learned in one fluid motion. Are any numerals drawn backwards or upside down? Are the same numerals always formed in this manner, or is this a random occurrence? Check this at other times to see which is the case. Attach this sheet to the evaluation pack.
C) Reverses numbers.: Sometimes a student has simply not mastered the correct direction and more practice is needed. In older students (eight and up), forming the letters in reverse can be a sign that there may be learning difficulties, especially if reading is very difficult and a word like "saw" is written or read as "was." A more in-depth reading evaluation would need to be done in this case. Attach this sheet to the evaluation pack.

Lesson: See *Mathematics Their Way*, Chapter 2.

Addition

Materials - Any manipulative, paper, and pencil   3
Write the equation $3 + 2 =$ _____ or write it vertically: $\underline{+\ 2}$.
Ask, **"Have you done a problem like this before? How do you solve it?"** If she is able to record five as the sum, have her build or prove the answer with blocks. Say, **"Show me what this means."** If the student:
A) Puts out two blocks for the two and three blocks for the three, pushes all the blocks together and says the answer is five: Give her a more difficult problem. For example, 7 + 5. If she can successfully do this problem, ask her to make up and write three problems: a very easy one, a very hard problem, and a problem that is not too hard but also not too easy. If the hard problem is too hard, watch and see how she deals with it. Tell her she doesn't have to answer it right now. You are getting a range of her ability. It will tell you where to start working and what size problem she is currently working on. Staple this paper to her evaluation sheet.
B) Tells you two plus three equals five or is blank: Have her do the problem in her head, with blocks, or on her fingers: If she is not sure what to do and can't read the equation, have her build it. Point to the two. Say, **"Put out this many blocks."** Have her do this. Point to the three. Say, **"Put out this many blocks."** Have her do this. Ask, **"How many blocks in all?"** She should be able to count them one by one or say five immediately. This may make her remember having done this

before but without the symbols.

C) Is uncertain about what she is doing: End the evaluation.

Lessons: *Patterns in Arithmetic: Addition - Booklet 1*; Review *Mathematics Their Way*, Chapters 7, 8, and 9.

Subtraction

Materials - Any manipulative, paper and pencil

After the student has successfully completed the addition test, try some subtraction problems. If the addition test was difficult, do not go on to subtraction. You are pushing to see what the student knows and what needs to be worked on.

Write the equation 5 - 1 = ___ or write it vertically: $\frac{5}{-1}$.

Ask, **"Have you done problems like this before? How would you solve 5 - 1?"** If she is able to record four as the difference, ask, **"How could you prove this answer with blocks?"**
If the student:

A) Puts out five blocks and takes away one block from the five: Give her a more difficult problem. For example, 8 - 3. If this problem is done successfully, have her make up and write three problems: a very easy one, a medium problem that is not too hard but also not too easy, and a really hard problem. If the hard problem is too hard, watch and see how she deals with it. Ask, **"How do you think you would prove it (or build it)?"** If she cannot answer the hardest one, admire it, and tell her she will learn how to answer it. You are getting a range of her ability. It will tell you where to start working and what size problem she is currently working on. Attach this sheet, note the level of the problems and the student's level of self-confidence and self challenge. The student may be ready for *Patterns in Arithmetic: Subtraction - Booklet 2.*

B) Puts out five blocks and adds one block to represent the one being taken away, then takes one block away, leaving five blocks: The student has not successfully proven the solution with manipulatives. Try another problem to see if she can subtract rotely but just doesn't have a physical model for prov- ing the answer. See *Patterns in Arithmetic: Subtraction - Booklet 1* for building subtraction models.

C) Is uncertain about what she is doing: End the test.

Basic Mathematical Knowledge

Patterns in Arithmetic: Subtraction - Booket 1 assumes that the student has learned what is typically taught to a five-year- old or in kindergarten. A student should have the following basic mathematical knowledge before beginning this program:

Counting - count out loud to about 20.
Concept of Number/Cardinality - to about 6.
One-to-one Correspondence - to 8.
Symbolic Concept of Number - to 10.
Addition - can add numbers with sums up to 20.
Subtraction - none, it will be learned.

Evaluation

Name_____   Date_____

Counting

Concept of Number/Cardinality   4   5   6   7   8   9

1:1 Correspondence   _____Highest number successfully counted

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Symbolic Concept of Number/Written Number

Addition

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Subtraction

Comments

Fishy Game

Adapted from The Whale Game, page 188[1]

Purpose

The purpose is to add and subtract with edible manipulatives and to make and verify story problems by doing them with concrete objects.

Prerequisites

Counting, one-to-one correspondence (see *Evaluation*). Please read A Guideline to the Lessons before starting the lessons.

Materials

Paper towel, Pepperidge Farm Goldfish crackers (or popcorn or any other small cracker in animal shapes), clean hands

Lesson

Each student is given the same number of fish crackers on a paper towel. Each person holds out one hand that is to be the ocean. The fish are left on the paper towel.

Dialogues are taken from actual conversations with students.
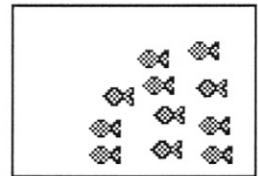
A dialogue such as this may follow:

"In the ocean there were three fish." [Everyone puts three fish in the ocean from the paper towel.]
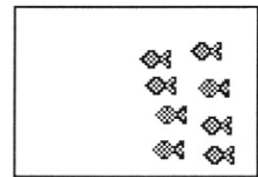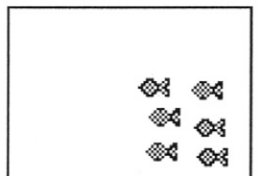
Look around to see if each student has three fish in her hand. Allow the student to figure out what is wrong. Do not tell her what to do if she has the incorrect amount.

"The three friends were having a good time playing leap fish." [Pause to play leap fish.]
"Along came two more fish and asked if they could play too."
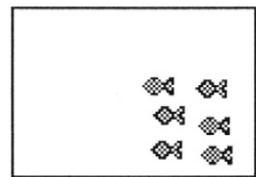[Two more fish are added to the ocean.]

"How many fish are in the ocean now?" "Five."

"The five friends were having so much fun that they didn't notice an octopus creeping up toward them. Just in time one of the fish saw the octopus and warned the other fish. But one fish was too slow to hide in a cave and the octopus ate it."

[Everyone eats one fish.]
"How many fish are left?" "Four."

[1]Adapted with permission from *Mathematics Their Way* by Mary Baratta-Lorton. Copyright ©1976 by Addison-Wesley Publishing Company.