

CHAPTER 8 – DEVELOPING EARLY NUMBER CONCEPTS AND NUMBER SENSE

This chapter looks at the development of number ideas for numbers up to about 20.

Ten research- based recommendations to help teachers develop high- quality learning activities for children aged 3 to 6:

1. Enhance children’s natural interest in mathematics and their disposition to use it to make sense of their physical and social worlds
2. Build on children’s experience and knowledge, including their family, linguistic, cultural, and community backgrounds; their individual approaches to learning; and their informal knowledge
3. Base mathematics curriculum and teaching practices on knowledge of young children’s cognitive, linguistic, physical, and social- emotional development
4. Use curriculum and teaching practices that strengthen children’s problem- solving and reasoning processes as well as representing, communicating, and connecting mathematical ideas
5. Ensure that the curriculum is coherent and compatible with known relationships and sequences of important mathematical ideas
6. Provide for children’s deep and sustained interaction with key mathematical ideas
7. Integrate mathematics with other activities and other activities with mathematics 8. Provide ample time, materials, and teacher support for children to engage in play, a context in which they explore and manipulate mathematical ideas with keen interest
9. Introduce mathematical concepts, methods, and language, through a range of appropriate experiences and teaching strategies
10. Support children’s learning by thoughtfully and continually assessing all children’s mathematical knowledge, skills, and strategies

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COUNTING

More,” “ less,” and “ same”

- To help children with the concept of less, frequently pair it with the word more and make a conscious effort to ask “ which is less?” questions as well as “ which is more?” questions.
- For all three concepts (more, less, and same), children should construct sets using counters as well as make comparisons or choices between two given sets
- Children still learning the skills of counting— that is, matching oral number words with objects— should be given sets of blocks or counters that they can move or pictures of sets that are arranged in a pattern for easy counting.
- To develop their understanding of counting, engage children in almost any game or activity that involves counts and comparisons.

Numeral Writing and Recognition

- The calculator is a good instructional tool for numeral recognition. In addition to helping children with numerals, early activities can help develop familiarity with the calculator so that more complex activities are possible.

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- Perhaps the most common preschool and kindergarten exercises have children match sets with numerals. When children are successful with these activities, it is time to move on to more advanced concepts.

RELATIONSHIPS AMONG NUMBERS 1-10

PATTERNED SETS

Naming amounts without the routine of counting can then aid in “counting on” (from a known patterned set) or learning combinations of numbers (seeing a pattern of two known smaller patterns).

Use a set of dot plates

ONE AND 2 MORE, ONE AND 2 LESS

- The words more and less can be paired or substituted with add and subtract to connect these ideas with the arithmetic operations, even if they have not yet been formally introduced.
- The calculator can be an exciting device to practice the relationships of one more than, two more than, one less than, and two less than.
- The two- more- than relationship should be extended to two- digit numbers as soon as students are exposed to them. One way to do this is to ask for the number that is two more than 7. After getting the correct answer, ask “What is two more than 37?” and similarly for other numbers that end in 7. *When you try this for 8 or 9, expect difficulties and unusual responses such as two more than 28 is “twenty- ten.” In the first grade, this struggle can prove quite valuable.*

ANCHORING #S TO 5 & 10

- The most common and perhaps most important model for this relationship is the ten- frame. The ten- frame is simply a 2×5 array in which counters or dots are placed to illustrate numbers
- For children in kindergarten or early first grade who have not yet explored a ten- frame, it is a good idea to begin with a five- frame.
- Introduce the following rule for showing numbers on the ten- frame: Always fill the top row first, starting on the left, the same way you read. When the top row is full, counters can be placed in the bottom row, also from the left. This will produce the “standard” way to show numbers on the ten- frame.
- For a while, many children will count every counter on their ten- frame. Some will take all counters off and begin each number from a blank frame. Others will soon learn to adjust numbers by adding on or taking off only what is required, often capitalizing on a row of five without counting. Do not pressure students. With continued practice, all students will grow. How they are using the ten- frame provides you with insights into students’ current number concept development.
- To add another dimension, have the children tell, before changing their ten- frames, how many more counters need to be added (“plus”) or removed (“minus”). They then should state plus or minus the correct amount.

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- Important variations of “Ten- Frame Flash” include • Saying the number of spaces on the card instead of the number of dots • Saying one more than the number of dots (or two more, and also one or two less than) • Saying the “10 fact”— for example, “Six and four make ten”
- Ten- frame tasks are surprisingly problematic for students. Students must reflect on the two rows of five, the spaces remaining, and how a particular number is more or less than 5 and how far away from 10.

PART PART WHOLE RELATIONSHIPS

- Most part- part- whole activities focus on a single number for the entire activity.
- A wide variety of materials and formats for these activities can help maintain student interest.
- When children do these activities, have them say or “read” the parts aloud or write them down on some form of recording sheet (or do both). Reading or writing the combinations serves as a means of encouraging reflective thought focused on the part- whole relationship. Writing can be in the form of drawings, numbers written in blanks (____ and ____), or addition equations if these have been introduced ($3 + 5 = 8$). *There is a clear connection between part- part- whole concepts and addition and subtraction ideas.*

Part-Part-Whole

- Ask children to read” a number sentence to go with each of their combinations. Encourage children to read their number sentences to each other. Two or three children working together with the same materials may have quite a large number of combinations including lots of repeats. Remember, the children are focusing on the combinations.

Missing Part

- In a missing- part activity, children know the whole amount and use their already developed knowledge of the parts of that whole to try to tell what the covered or hidden part is. They also serve as the forerunner to subtraction concepts.

DOT CARDS assist in developing multiple relationships (all 4)

RELATIONSHIPS 10-20

- It should not be assumed that they will automatically extend the set of relationships they developed on smaller numbers to the numbers beyond 10; however, the numbers between 10 and 20 are not an appropriate place to discuss place- value concepts.
- Initially, children do not see a numeric pattern in the numbers between 10 and 20. Rather, these number names are simply ten additional words in the number sequence.
- Use Crazy mixed up numbers activity: Have children share their ideas. Not every child will use a full set of ten, but as this idea becomes more popular, the notion that ten and some more is a teen amount will soon be developed.

DOUBLES AND NEAR DOUBLES

- There is no reason why children should not begin to develop these relationships long before they are concerned with memorizing basic facts. Doubles and near-doubles are simply special cases of the general part- part- whole construct.
- Relate the doubles to special images. Children can draw pictures or make posters that illustrate the doubles for each number. Any images that are strong ideas for your children will be good for them.

NUMBER SENSE IN THEIR WORLD

- Have children select the number and the unit or things (10 kids, 20 bananas, . . .), and see what kinds of questions children make up. When a difference of opinion develops, capitalize on the opportunity to explore and experiment.
- Children can easily begin to pose their own questions and explore number in the part of the environment most interesting to them. Children will not have these real- world connections when you begin, and you may be disappointed in their initially limited ideas about number.
- Children need to develop multiple answers to the question “ What comes to your mind when I say twenty- four?”

ESTIMATION and MEASUREMENT

- In the early grades, measures of length, weight, and time are good places to begin.
- Just measuring and recording results will not be very effective unless there is a reason for children to be interested in or think about the result. To help children think or reflect on what number might tell how long the desk is or how heavy the book is, it would be good if they could first write down or tell you an estimate.
- To produce an estimate is, however, a very difficult task for young children. They do not easily grasp the concept of “ estimate” or “ about.”

EXTENSIONS TO EARLY MATHEMATICS

Teachers in the second and third grades can capitalize on some of the early number relationships and extend them to numbers up to 100. A useful set of materials to help with these relationships is the little ten- frames

The following three ideas can be demonstrated using the little ten- frames

- the relation-ships of one more than and one less than. If you understand that one more than 6 is 7, then in a similar manner, one more ten than 60 is 70
- fact strategies. If a child has learned to think about adding on to 8 or 9 by first adding up to 10 and then adding the rest, the extension to similar two- digit numbers is quite simple;
- Finally, the most powerful idea for small numbers is thinking of them in parts.