Four Problem Structures

Join Problems:

Three quantities involved: starting amount, change amount (added or joined), resulting amount (total after change).

* Result Example: Sandra had 8 pennies. George gave her 4 more. How many pennies does Sandra have altogether?
* Change: Sandra had 8 pennies. George gave her some more. Now Sandra has 12 pennies. How many did George give her?
* Initial: Sandra had some pennies. George gave her 4 more. Now Sandra has 12 pennies. How many pennies did Sandra have to begin with?

Separate Problems:

Same three quantities involved only the initial amount is the whole amount. In these problems, the change is the amount being removed from the initial amount.

* Result: Sandra had 12 pennies. She gave 4 pennies to George. How many pennies does Sandra have now?
* Change: Sandra had 12 pennies. She gave some to George. Now she has 8 pennies. How many did she give to George?
* Initial: Sandra had some pennies. She gave 4 to George. Now Sandra has 8 pennies left. How many pennies did Sandra have to begin with?

Part-Part Whole Problems:

Two parts that combine into a whole.

* Whole Unknown: (mental combination) George has 4 pennies and 8 nickels. How many coins does he have?
* Part Unknown: (physical action) George and Sandra put 12 pennies into the piggy bank. George put in 4 pennies. How many pennies did Sandra put in?

Compare Problems:

Comparing two quantities, the difference being the third amount.

* Difference Unknown: George has 12 pennies and Sandra has 8 pennies. How many more pennies does George have than Sandra?
* Larger Unknown: George has 4 more pennies than Sandra. Sandra has 8 pennies. How many pennies does George have?
* Smaller Unknown: Sandra has 4 fewer pennies than George. George has 12 pennies. How many pennies does Sandra have?

\*\*It is a good idea to have the students do the problems in many ways, such as use counters or other manipulatives. Also, they can make an equation to represent the problem after they have used the counters.

\*\* There is a lot of emphasis put on the easier join and separate problems with the result unknown. The definition of Addition and Subtraction is not “put together” and “take away,” because if students think this then they will have a difficult time when the structure of addition and subtraction is different.

Contextual Problems:

* These story problems should relate to children’s lives, so that they can develop an outlook on how math is used in the real world.
* Example: Using cubes to measure how tall the students are in the class, and then comparing them to each other or other items.
* Instead of having a student just work out a problem, allow them to use words, pictures, and numbers to explain how they solved the problem and provide a reason why they think they are correct.
* Counting Coins and Combinations (pg. 150): begin with telling students that they are going to be hearing a story, have them picture the story in their minds, and to be ready to put the problem in their own words. Have the students share if they think that the answer will be more or less than 16. The students are then allowed to solve the problem by using whatever materials or methods they want. They are required to show their work in a way that if someone else were to look at their work, then they should be able to understand what they did to solve the problem. Students are allowed to share their strategies with the class as a whole during a whole-class discussion. The teacher at this time should ask questions to help the students further understand their reasoning.
* Use counters or actual experiments for pre-K and Kindergarteners.
* Introduce symbols (+,-,=, etc.) through a discussion of a story problem, when you feel that students are ready.
* Put a lot of emphasis on the fact that the equal sign means “is the same as” and not that an answer is coming up. Think of the equal sign as a balance, making sure that one side equals the other side.
* It is good to watch how your students solve their story problems, because it will allow you to be able to know what questions to ask or what numbers to use in future problems.

Model-Based Problems:

* Addition: have students use counters in separate piles or use two different colors of counters. This way the students can understand that there are two parts that are making the answer, or the whole.
* Number lines: instead of focusing on the hash marks or the numbers on the number line, it is good to use arrows (hops) to represent the number.
* Number line activity: put a large number line on the floor and have students walk or hop to represent the number you want them to.
* Missing part subtraction activity: use connecting cubes and have the students connect some. Then have the students take some off and say the equation. Example: There are 9 connecting cubes, a child takes 4 off, the child should then say the equation “9 minus 4 equals 5.”
* Subtraction as Think-Addition: after the activity using the connecting cubes, it is a good time to have a discussion about how there can be two equations written for the same model (addition and subtraction). Subtraction: 9-4=5, Addition: 5+4=9.
* Comparison Models: use counters and have the students make two uneven columns side by side. Have them use yarn to connect one counter in one column to the one beside it in the other column. When finished, it should show what is left, which would be the difference between the two numbers.

Properties of Addition and Subtraction:

* The Commutative Property for Addition: (It makes no difference in which order two numbers are added) pair problems that have the same addends but in different orders. The content should also be different in each problem. Example: 1.Tania is on page 32 in her book. Tomorrow she hopes to read 15 more pages. What page will she be on if she reads that many pages? 2. The milk tray in the cafeteria was down to only 15 cartons. Before lunch, the delivery person brought in some more milk. She filled up the tray with 32 more cartons. How many cartons does the mild tray hold?
* The Associative Property for Addition: (when adding three or more numbers, it does not matter whether the first pair are added first or if you start with any other pair of addends) give mental grouping numbers in a problem along with other numbers and have the students solve it. Example: 5+5+9.
* The Zero Property: (zero is an identity element in addition or subtraction) Explain how it doesn’t make a number bigger when adding or smaller when subtracting, which is what students may think occasionally.