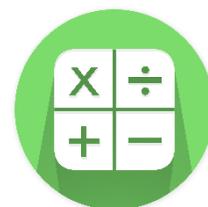


COGNITIVELY GUIDED INSTRUCTION IN MATHEMATICS

A “major thesis of CGI is that children solve problems naturally by attending to the context. Having students learn problem type names or identify the problem type would be counterproductive, because it would distract students from attending to and responding about the context. Similarly we do not recommend that children be taught key word strategies to help them solve problems. Such strategies are ineffective in dealing with anything but a narrow set of problem situation and discourage students from making sense of the problems they solve.” (Carpenter, Fennema, Franke, Levi, & Empson, 2015, p. 14)



Addition and Subtraction Problem Types

Join Problems

- ✓ Direct or implied action in which a set is increased by a particular amount.

Separate Problems

- ✓ Action takes place over time but in this case the action in the problem is one in which the initial quantity is decreased rather than increased.

Part-Part-Whole Problems

- ✓ There is no direct or implied action, and there is no change over time.
- ✓ One set is not being joined to the other.
- ✓ Both subsets assume equivalent roles in the problem

Compare Problems

- ✓ Involve relationships between quantities rather than a joining or separating action.
- ✓ Involve the comparison of two distinct, disjoint sets rather than the relationship between a set and its subsets.
 - Mark has 8 mice. *Referent set*
 - Joy has 12 mice. *Compare set*
 - Joy has 4 more mice than Mark. *Difference*

Addition and Subtraction Problem Types		
<p>Join (Results Unknown) <i>Connie had 5 marbles. Juan gave her 8 more marbles. How many marbles does Connie have altogether?</i></p> $5 + 8 = \square$	<p>Join (Change Unknown) <i>Connie has 5 marbles. How many more marbles does she need to have 13 marbles altogether?</i></p> $5 + \square = 13$	<p>Join (Start Unknown) <i>Connie had some marbles. Juan gave her 5 more marbles. Now she has 13 marbles. How many marbles did Connie have to start with?</i></p> $\square + 5 = 13$
<p>Separate (Results Unknown) <i>Connie had 13 marbles. She gave 5 to Juan. How many marbles does Connie have left?</i></p> $13 - 5 = \square$	<p>Separate (Change Unknown) <i>Connie had 13 marbles. She gave some to Juan. Now she has 5 marbles left. How many marbles did Connie give to Juan?</i></p> $13 - \square = 5$	<p>Separate (Start Unknown) <i>Connie had some marbles. She gave 5 to Juan. How many marbles did Connie have to start with?</i></p> $\square - 5 = 8$
<p>Part-Part-Whole (Whole Unknown) <i>Connie has 5 red marbles and 8 blue marbles. How many marbles does she have?</i></p> $5 + 8 = \square$	<p>Part- Part- Whole (Part Unknown) <i>Connie has 13 marbles. 5 are red and the rest are blue. How many blue marbles does Connie have?</i></p> $13 = 5 + \square$	
<p>Compare (Difference Unknown) <i>Connie has 13 marbles. Juan has 5 marbles. How many more marbles does Connie have than Juan?</i></p> $13 - 5 = \square$	<p>Compare (Compare Quantity Unknown) <i>Juan has 5 marbles. Connie has 8 more than Juan. How many marbles does Connie have?</i></p> $5 + 8 = \square$	<p>Compare (Referent Unknown) <i>Connie has 13 marbles. She has 5 more marbles than Juan. How many marbles does Juan have?</i></p> $5 + \square = 13$

Multiplication and Division Problem Types

Multiplication Problems

- ✓ Give the number of groups and the number of objects in each group
- ✓ Unknown is total number of objects

Measurement Division Problems

- ✓ Give the total number of objects and the number of objects in each group.
- ✓ The number of groups is unknown
- ✓ Children use the number of objects in each group to **measure** the total number of objects.

Partitive Division Problems

- ✓ Give the total number of objects and the number of groups.
- ✓ Number of objects per group is unknown.
- ✓ Children **partition** the total number of objects into a given number of groups.

Problems Type	Number of Groups	Amount per group	Total
Multiplication <i>Megan has 5 bags of cookies with 3 cookies in each bag. How many cookies does Megan have?</i>	5	3	Unknown
Partitive Division <i>Megan has 15 cookies. She puts the cookies into 5 bags with the same number of cookies in each bag. How many cookies does she put in each bag?</i>	5	Unknown	15
Measurement Division <i>Megan has 15 cookies. She puts 3 cookies in each bag. How many bags can she fill?</i>	Unknown	3	15

Bibliography

Carpenter, T. P., Fennema, E., Franke, M. L., Levi, L., & Empson, S. B. (2015). *Children's Mathematics Cognitively Guided Instruction*. Portsmouth: Heinemann.