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The analysis of children's understanding of operations on whole numbers.

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Summary: The study has been conducted with 29 children from 4th to 6th grades to realize how they understand addition, "subtraction", multiplication, and division of whole numbers, and how their understanding influences the solving of one-step word problems. Children's understanding of operations was categorized into "adding" and "combination" for additions, "taking away" and "comparison" for subtractions, "equal groups," "rectangular arrange," "ratio," and "Cartesian product" for multiplications, and "sharing," "measuring," "comparison," "ratio," "multiplicative inverse," and "repeated subtraction" for divisions. Overall, additions were mostly understood additions as "adding" (86.2%), subtractions as "taking away" (86.2%), multiplications as "equal groups" (100%), and divisions as "sharing" (82.8%). This result consisted with the Fischbein's intuitive models except for additions. Most children tended to solve the word problems based on their conceptual structure of the four arithmetic operations. Even though their conceptual structure of arithmetic operations helps to better solve problems, this tendency resulted in wrong solutions when problem situations were not related to their conceptual structure. Children in the same category of understanding for each operation showed some common features while solving the word problems. As their understanding of operations significantly influences children's solutions of word problems, they need to be exposed to many different problem situations concerning the four arithmetic operations. Furthermore, the focus of teaching must be on the meaning of each of the operations rather than the computational algorithms.

Classification: C32 C33 F32 F33 F92 F93 D72 D73

Keywords: research; four rules; first arithmetic instruction; natural numbers; computation; non-routine problems; comprehension; concept formation; intuition models; semantic structure of word problems