

Research-Based Practice: Schema-Based Instruction for Mathematical Problem Solving

References:

- Fuchs, L. S., Seethaler, P. M., Powell, S. R., Fuchs, D., Hamlett, C. L., & Fletcher, J. M. (2008). Effects of preventative tutoring on the mathematical problem solving of third-grade students with math and reading difficulties. *Exceptional Children, 74*, 155–173.
- Jitendra, A. K., Griffin, C., Haria, P., Leh, J., Adams, A., & Kaduvetoor, A. (2007). A comparison of single and multiple strategy instruction on third grade students' mathematical problem solving. *Journal of Educational Psychology, 99*, 115–127.
- Jitendra, A. K., Star, J., Starosta, K., Leh, J., Sood, S., Caskie, G., et al. (2009). Improving students' learning of ratio and proportion problem solving: The role of schema-based instruction. *Contemporary Educational Psychology, 34*, 250–264.
- Xin, Y. P., Jitendra, A. K., & Deatline-Buchman, A. (2005). Effects of mathematical word problem solving instruction on students with learning problems. *Journal of Special Education, 39*, 181–192.

Description: There are five structures (schemata) featured in mathematic word problems: change, group, compare, restate, and vary (Marshall, 1995). These are grouped into either additive or multiplicative structures. See table below (Kalyuga, 2006):

Additive (require addition or subtraction)	Multiplicative (requires multiplication or division)
<p>Change: begins with an initial quantity that is changed either by adding or subtracting.</p> <p>Group: a number of smaller groups combining to form a new larger group (part-to-whole).</p> <p>Compare: Compares two different sets emphasizing the relation between the two sets.</p>	<p>Restate: Ratio-type situations. A relation exists between two things (e.g. twice as much), and the same relation applied to two different values describing the same things.</p> <p>Vary: If-then relationships. A relationship exists between the amounts of two things. So, as the amount of one thing increases or decreases the amount of the second things changes in the same fixed way.</p>

To support students in using the understanding of schemata to solve problems, the following four-step strategy (FOPS) can be used (Jitendra et al., 2009):

- F: Find the problem type
- O: Organize the information in the problem using a diagram
- P: Plan to solve the problem using the diagram
- S: Solve the problem