



Using Schema-Based Instruction to Teach Math

What is the evidence base?

- This is an evidence-based practice for **students with disabilities** based on four methodologically sound group studies with random assignment across 197 students with disabilities and four methodologically sound single subject studies across 17 students with disabilities.
- This is a research-based practice for **students with learning disabilities** based on two methodologically sound group experimental studies with random assignment and two methodologically sound single subject studies across 41 participants with learning disabilities.
- This is a research-based practice for **students with intellectual disabilities** based on two methodologically sound single subject studies across nine participants with intellectual disabilities.

Where is the best place to find out how to do this practice?

The best place to find out how to implement schema-based instruction to teach math is through the following research to practice lesson plan starters:

- [Using Schema-Based Instruction to Solve One-Step Word Problems \(Jitendra, Hoff, & Beck, 1999\)](#)
- [Using Schema-Based Instruction to Solve Multiple-Step Word Problems \(Jitendra, Hoff, & Beck, 1999\)](#)

- Students with
 - **Learning Disabilities (4 studies; n=41)**
 - **Intellectual Disability (2 studies; n=9)**
 - ADHD (1 study; n=1)
 - Severe Emotional Disability (1 study; n=1)
 - General Special Education (2 studies; n=163)
- Ages ranged from 11-14
- Males (n=36), females (n=18), Not reported (n=118)
- Ethnicity
 - Caucasian (n=58)
 - African American (n=15)

- Hispanic (n = 31)
- None reported (n=110)

What is the practice?

Schema-based instruction has been defined as a representational strategy focused on schemata (i.e., problem pattern or structure) identification. Schema-based instruction entails “looking systematically for patterns, are very close to content curriculum goals” (NCTM, 1998, pg. 4). A characteristic of schema-based strategy instruction is the use of schemata diagrams to map important information and highlight relationship in the problem to assist in translating the problem so it can be solved (Jitendra, DiPipi, & Perron-Jones, 2002).

In the studies used to establish the evidence base for using schema-based instruction to teach math included using a:

- Modified schema-based instruction to teach mathematical word problem solving skills and discrimination between problem types to middle school students (Browder et al., 2017).
- Schema-based word problem solving instruction with middle school students with learning disabilities (Jitendra, Hoff, & Beck, 1999; Jitendra et al., 2002; Xin, Jitendra, & Deatline-Buchman, 2005).
- Schema-based instruction to teach proportional reasoning with middle school students (Jitendra et al., 2011; Jitendra Star, Dupuis, & Rodriguez, 2013).
- Schema-based instruction to teach ratio and proportion to middle school students (Jitendra et al., 2009).
- Modified schema-based instruction to teach personal finance problem solving skills to middle school students (Root et al., 2017).

How has the practice been implemented?

- Schema-based instruction was used to teach
 - How to solve math word problems and differentiate between problem types (Browder et al., 2017).
 - How to solve one-step and two-step addition and subtraction word problems and maintenance over time (Jitendra et al., 1999).
 - How to solve one-step multiplication and division word problems and if skills will generalize to multi-step word problems (Jitendra et al., 2002; Xin et al., 2005).
 - How to solve ratio, proportion, and percent word problems (Jitendra et al., 2009; Jitendra et al., 2013).
 - How to solve ratio, proportion, and percent word problems and in combination with small group tutoring for one group (Jitendra et al., 2011).
 - How to solve personal finance word problems (Root et al., 2017).

Where has it been implemented?

- Special Education classroom (3 studies)

- General Education classroom (4 studies)
- Special Education and General Education for generalization (1 study)

How does this practice relate to Common Core Standards?

Analyze proportional relationships and use them to solve real-world and mathematical problems (Math, Grade 7).

- Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. [CCSS.MATH.CONTENT.7.RP.A.1](#)
- Recognize and represent proportional relationships between quantities. [CCSS.MATH.CONTENT.7.RP.A.2](#)
- Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error. [CCSS.MATH.CONTENT.7.RP.A.3](#)

Solve real-life and mathematical problems using numerical and algebraic expressions and equations (Math, Grade 7).

- Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. [CCSS.MATH.CONTENT.7.EE.B.3](#)

References used to establish this evidence base:

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- Jitendra, A. K., Hoff, K., & Beck, M. M. (1999). Teaching middle school students with learning disabilities to solve word problems using a schema-based approach. *Remedial and Special Education*, 20, 50-64.
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Root, J. R., Saunders, A., Spooner, F., & Brosh, C. R. (2017). Teaching personal finance mathematical problem solving to individuals with moderate intellectual disability. *Career Development and Transition for Exceptional Individuals, 40*, 5-14.

Xin, Y. P., Jitendra, A. K., & Deatline-Buchman, A. (2005). Effects of mathematical word Problem—Solving instruction on middle school students with learning problems. *The Journal of Special Education, 39*, 181-192.

This Practice Description was developed by The National Technical Assistance Center on Transition (NTACT), Charlotte, NC, funded by Cooperative Agreement Number H326E140004 with the U.S. Department of Education, Office of Special Education and Rehabilitative Services (OSERS). This document has been reviewed and approved by the OSERS. Opinions expressed herein do not necessarily reflect the position or policy of the U.S. Department of Education nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Department of Education. OSEP Project Officer: Dr. Selete Avoke. RSA Project Officer: Kristen Rhinehart-Fernandez. This product is public domain. Authorization to reproduce it in whole or in part is granted. While permission to reprint this publication is not necessary, the citation should be: National Technical Assistance Center on Transition (2017). *Schema-Based Instruction to Teach Math*.

