

Designing Instruction to Support Students Who Struggle with Mathematics NCTM 2015

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- **References/Resources:**
 - What Works Clearinghouse (WWC) Practice Guide:
Assisting Students Struggling with Mathematics: RTI for Elementary & Middle Schools (2009) <http://ies.ed.gov/ncee/wwc/publications/practiceguides/>
 - Forbringer, L., & Fuchs, W. (2014). *RTI in Math: Evidence-Based Interventions for Struggling Students*. New York: Routledge.

- Learners who struggle with mathematics frequently have deficits in
 - Memory (working memory & long-term storage & retrieval)

 - Language

 - Executive functioning (task sequencing & self-monitoring)

 - Attention

 - Motivation

- **WWC Recommendations:**
 1. Universal screening → tiered, targeted interventions
 2. Monitor progress & adjust interventions
 3. Focus on foundational skills (whole numbers & rational numbers)
 4. Include motivational support
 5. Develop fluency with basic facts
 6. Use explicit instruction during interventions
 7. Use visual representations
 8. Use underlying structures to teach problem-solving

- **WWC Recommendation: Develop Fluency with Basic Facts**

“Interventions at all grade levels should devote about 10 minutes each session to building fluent retrieval of basic arithmetic facts.”

- **WWC Recommendation: Use Explicit Instruction During Interventions**
 - Lesson Plan Styles:
Less teacher direction = Inquiry ↔ More direction = Explicit Instruction

- **Components of Explicit instruction:**
 1. Lesson introduction: Activate background knowledge
 - Link new information to preexisting knowledge
 - Use warm-ups: Each student actively practices each prerequisite skill
 2. Lesson presentation
 - Introduce information in small chunks! (WWC suggests focusing on no more than two new facts in one lesson)
 - Model explicit strategies
 - Model your thinking ('think-aloud')
 - Provide multiple examples
 3. Guided Practice
 - Purpose = Make sure students understand before they practice on their own
 - Practice the same skill introduced in the presentation
 - Provide scaffolded support; gradually fade support
 - Check for student understanding
 - Have students verbalize their reasoning
 4. Independent Practice
 - Instructional alignment (practice activities match the presentation & guided practice)
 - Students with a history of failure need 90-95% success to maintain motivation
 - Interleave worked example solutions and problem-solving exercises

- **WWC Recommendation: Use Visual Representations**
 - Follow the CRA Continuum
 - Concrete Representation (3-dimensional models)
 - Visual/Pictorial Representation (e.g. drawings, numberlines, diagrams, tally marks)
 - Abstract Representation (words, numbers, symbols)
 - Timeline for progressing from $C \rightarrow R \rightarrow A$
 Research studies show that students with learning disabilities need at least three lessons using manipulatives before transitioning to just using pictures, tally marks or other 2-dimensional models, and at least three lessons using 2-dimensional visual representations before they are able to work using only abstract representations (words, & symbols).
 - Explicitly Link CRA
- **WWC Recommendation: Use Underlying Structures to Teach Problem Solving**
 - Example: 3 basic addition/subtraction structures: Change, Group, Compare
 - Arranging information on the graphic organizer \rightarrow the mathematical equation
 - Resources:
 - *Solving Math Word Problems* by Jitendra
<http://www.proedinc.com/customer/productView.aspx?ID=4145>
 - *Go Solve Computer Program*
<http://www.tomsnyder.com/products/product.asp?SKU=GOSGOS>
 - *Step-by Step Model Drawing* by Char Forsten (Singapore Math)
 - *Thinking Blocks*: <http://www.mathplayground.com/wordproblems.html>
 (free online program)
- **Locating Evidence-Based Materials**
 - What Works Clearinghouse
<http://ies.ed.gov/ncee/wwc/findwhatworks.aspx>
 - National Center on Intensive Intervention
<http://www.intensiveintervention.org/resources/tools-charts>
 - Academic Progress Monitoring Tools Chart
 - Academic Intervention Programs Tools Chart