Schema-Based Instruction of Mathematics Addition and Subtraction Word Problems for Students with ED

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What is ED?

- Definition of “emotional disturbance” (Section 300.8 IDEA, 2004):
  - an inability to learn that cannot be explained by intellectual, sensory or health factors
  - an inability to build or maintain satisfactory interpersonal relationships with peers and teachers
  - inappropriate types of behavior or feelings under normal circumstances
  - a general pervasive mood of unhappiness or depression
  - a tendency to develop physical symptoms or fears associated with personal or school problems.
ED & Academic Achievement

- Children with ED tend to perform poorly academically.
- Common academic problems are:
  - failing classes
  - large number of absences
  - being retained a grade
  - dropping out of school
Math is one area, in particular, where children with ED struggle.

- 1.8 grade levels behind their nondisabled peers (Wagner, 1995)
- difficulty with problem-solving and reasoning (Maccini & Gagnon, 2000)
- 42% of children with ED passed the Minnesota’s 1996 Basic Standards Test in math (Thurlow et al., 1998).
ED & Academic Achievement

Two possible reasons for poor performance:

- Lack of interventions that focus on improving math skills
  - More focus on behavioral problems
- Higher standards in math curriculum for general classrooms.
  - Focus now on complex math skills like problem-solving and reasoning.
ED Interventions

- Elements of good intervention (Maccini & Gagnon, 2000)
  - effective instructional techniques
    - explicit strategy instruction
    - mastery learning
    - immediate error corrections
    - fading teacher involvement
    - providing a wide range of examples and non-examples to enhance generalization
    - teacher modeling
    - cumulative reviews of previously learned skills to assess progress.
  - the use of manipulators
  - real-life application
Schemas are the knowledge structures that an individual pulls from when recognizing or operating with aspects from his or her environment.

The child is taught how the semantic structure of the word-problem translates onto elements of the schema used in the problem-solving process.
Elements of schema

- problem schemata
  - Facts and descriptors about the situation in the word problem

- action schemata
  - Action procedures used to implement the situation identified in the problem schemata

- strategic knowledge
  - Rules, restrictions, and conditions that must be met to execute schema
SBI for ED

- SBI found to be effective with children with LD.
  - Performance improved
  - Children were able to generalize to novel math problems
  - Improvement was maintained up to 10 weeks
- Teaches complex math skills
  - Two-step problems, multiplication/division, & real-life word problems
- Contains many elements of an effective intervention
- One study found it to be effective with children with ED (Jitendra, et al. 2010)
Four steps in current SBI

- Identifying problem type
- Applying corresponding problem solving model
- Determining an operation
- Solving the problem
Categories of One-step Addition and Subtraction Word-problems

- Two categories
  Part-Part-Whole, Additive Compare

- Three categories
  change, group, compare

- Four categories
  Change, group, compare, equal
Simplified SBI intervention

- Four steps
  1. Read and identify
  2. Draw a diagram and organize

1. Decide the operation
2. Solve and check
Pretreatment assessment

- Direct skill assessment
  - Oral reading fluency
  - Math computation fluency
- Baseline data collection
  - Three data points
- Performance vs. skill deficit assessment
  - 50% improvement (Duhon et al., 2004)
  - Comparable performance
Experimental Design

- Single subject
- Multiple baseline
  Students enter intervention in a staggered fashion
- Progress monitoring and Maintenance
Sample word problems

- James and Marla each have a bag of marbles. James has 29 marbles. Marla has 55 marbles. How many more marbles does Marla have than James?

- Christine had 18 tropical fish, then she went to the pet shop and bought 12 more tropical fish, how many tropical fish did she end up with?
References