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Research to Practice

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Do Special Education Interventions Improve Learning of Secondary Content? A Meta-Analysis

Findings from special education studies at <http://nichcy.org/research/summaries>

This is a structured abstract of a meta-analysis conducted by Scruggs, Mastropieri, Berkeley, and Graetz, published in *Remedial & Special Education*. Full citation for this meta-analysis appears on page 4.

Abstract (from source)

The authors describe findings from a research synthesis on content area instruction for students with disabilities. Seventy studies were identified from a comprehensive literature search, examined, and coded for a number of variables, including weighted standardized mean-difference effect sizes. More than 2,400 students were participants in these investigations. Studies included interventions involving content areas, such as science, social studies, and English, and employed a number of different interventions, including study aids, classroom learning strategies, spatial and graphic organizers, mnemonic strategies, hands-on activities, classroom peers, and computer-assisted instruction. The overall effect size was 1.00, indicating an overall large effect across studies. Implications for future research and practice are described.

Background

Secondary school-aged students with mild disabilities (e.g., learning disabilities, emotional disturbance, and mild intellectual disabilities or developmental delays) are increasingly included in content area classes and state and national assessments. This meta-analysis examined the evidence base for some of the strategies most commonly used to teach middle and high school students with disabilities in the content areas of science (e.g.,

biology, chemistry), social studies (e.g., history, geography), and English. The researchers examined the following interventions:

- **Mnemonic strategies.** Mnemonic devices are patterns of letters, sounds, or associated ideas that aid people in remembering information. Keyword, pegword, and letter strategies were the mnemonic devices used in the studies included in this meta-analysis. These mnemonic techniques use acoustically linked proxy words to connect two pieces of information. For example, students were given the keyword "rainy day" and told to think of a frog sitting in the rain to remember that the scientific classification for common frogs is *ranidae*.
- **Spatial Organizers.** Spatial organizers help students understand and remember information by teaching them to sort concepts, facts, and ideas using charts, diagrams, graphs, or other graphic organizers.
- **Classroom Learning Strategies.** Study skills instruction, note-taking skills, self-questioning strategies, self-monitoring, summarization, and learning strategies were included under the category of classroom learning strategies in this review.

- **Computer-Assisted Instruction (CAI).** CAI programs use a variety of computer-based applications to deliver different types of instruction, including drill and practice, strategy instruction, and simulation.
- **Peer Mediation.** In this meta-analysis, peer mediation included peer tutoring and cooperative learning, where students are taught to help their classmates and work together on projects or assignments.

Research Design - *Meta-Analysis*

Number of Studies - 70

Years Spanned - 1984-2006

Research Subjects

Secondary school-aged students with disabilities receiving content area interventions in science, social studies, or English.

Specified Disability

Learning disabilities (67.1% of students)

Students with more than one disability (28.6%): learning disabilities (LD), emotional or behavioral disturbance (ED), and/or mild intellectual disabilities.

Emotional disturbance (4.3%)

Intervention

In order of their prevalence in the 70 studies, interventions were: mnemonic strategies (30.0%); spatial organizers (20.0%); classroom learning strategies (17.1%); computer-assisted instruction (10.0%); peer mediation (7.1%); study aids (5.7%); hands-on or activity-oriented learning (5.7%); and explicit instruction (4.3%).

Duration of Intervention

Intervention sessions ranged in number between 1 and 60 with a mean of 11.6 sessions. Their length ranged between 10 and 90 minutes, with a mean of 42.8 minutes.

- **Study Aids.** Study aids reviewed in this meta-analysis included both teacher-directed and student-directed study guides and advanced organizers such as text outlines.
- **Hands-On or Activity-Oriented Learning.** Hands-on and activity-oriented learning is most commonly seen in science labs where students perform experiments and work with the materials they are studying in order to learn concepts.
- **Explicit instruction.** Explicit instruction, also referred to as direct teaching, is composed of three strategies: teaching in small steps, guided practice, and independent practice.

Research Question

What are the best evidence-based practices in special education content area instruction for students at the secondary level?

Age/Grade of Subjects

All of the students included in this meta-analysis attended secondary school (i.e., middle school, junior high, or high school). The youngest students were sixth graders attending middle school or junior high. The mean grade level of participants was 8.3 and the mean age was approximately 14.5 years.

Findings

- **Mnemonic strategies.** The use of mnemonic instruction, particularly for helping students with LD learn facts in a variety of subject areas, has been extensively studied (n=21), and has shown very high effectiveness across studies. However, the researchers remind teachers that the mnemonic devices they studied specifically focused on teaching students to make verbal associations between facts. These strategies are effective in helping students to memorize material such as lists, groups, and chronologies. To increase the overall effectiveness of a lesson and promote a deeper understanding of the content to be learned, mnemonic instruction can be combined with many of the other interventions reviewed here.

- **Spatial Organizers.** Concept diagrams, concept comparison routines, and other graphic organizers were used to teach students diverse content in 14 of the studies reviewed. Spatial organizers were found to be an effective strategy to help secondary school-aged students learn content area knowledge.
- **Classroom Learning Strategies.** Overall, instructing students in methods for processing and studying content area subject matter, such as study skills instruction, note-taking strategies, self-questioning strategies, self-monitoring, and summarization, was very effective.
- **Computer-Assisted Instruction (CAI).** The seven studies on CAI programs found computer-based instruction to be moderately effective. However, most studies on CAI were conducted during the 1980s and 1990s; it is not known whether the same results would be found with current CAI programs.
- **Peer Mediation.** Peer mediation strategies such as peer tutoring and cooperative learning were found to promote content learning in both special education and inclusive classrooms.
- **Study Aids.** The use of study aids (e.g., study guides and advanced organizers such as text outlines) showed promising results with a large mean effect size across studies ($n=4$). However, the number of existing studies is small, and the researchers suggest that more studies should be conducted in this area.
- **Hands-On or Activity-Oriented Learning.** While encouraging students to interact with relevant materials in the form of science labs and other activities appears to be an effective way of teaching secondary school content, the low number of studies ($n=4$) made it difficult to draw firm conclusions.
- **Explicit instruction.** While the small number of interventions using explicit instruction ($n=3$) makes it difficult to draw conclusions about explicit instruction's true effectiveness, the effect size for the three studies the researchers analyzed that used explicit instruction was the highest for any strategy studied.

Combined Effect Size

Effect size is a statistical calculation that is often represented as ES or d . Effect size measures the impact of an intervention. An effect size of less than $d=0.20$ suggests that a treatment did not have a significant effect. Larger effect sizes indicate that the treatment has had some impact; for example:

- $d=0.20$ indicates a small or low impact
- $d=0.50$ indicates a moderate impact
- $d=0.80$ or above indicates a large impact

In this meta-analysis, the overall weighted mean effect size across all types of effects (i.e., treatment, maintenance, and generalization effects) was 1.00 (indicating a large impact). When this overall effect size was subdivided, it showed weighted mean effect sizes of 1.02 for treatment effects, 1.13 for maintenance effect, and 0.68 for generalization effects. The mean effect sizes for the strategies examined were:

- Mnemonic strategies (ES=1.47)
- Spatial or Graphic Organizers (ES=0.93)
- Classroom Learning Strategies (ES=1.11)
- Computer-Assisted Instruction (ES=0.63)
- Study Aids (ES=0.94)
- Hands-On or Activity-Oriented Learning (ES=0.63)
- Explicit instruction (ES=1.68)

Conclusion / Recommendations

Effect sizes ranging from moderate to very high were found for the seven instructional strategies examined in this meta-analysis.

When the studies were divided and examined by the type of setting in which they were conducted, interventions conducted in general and special education settings had relatively similar high effect sizes, while interventions conducted in a separate room within the school were significantly higher. Intervention sessions led by researchers had the highest effect sizes, followed by interventions led

by special educators, while interventions led by general educators had more moderate effect sizes.

The authors note that only a small number of the studies took place in inclusive classrooms and that previous studies of coteaching in inclusive class-

rooms have found that the effective strategies investigated in this study are rarely implemented in inclusive settings. The authors suggest future research into ways that special educators and general educators can work together to bring these interventions into secondary content classes.

Research Connections

Using Mnemonics to Teach Academic Skills
<http://www.nsttac.org/ebp/academiccebp/mnemonics.aspx>

Understanding Graphic Organizers
http://tccl.rit.albany.edu/knilt/index.php/Unit_One-_Understanding_Graphic_Organizers

The Power of Strategy Instruction
<http://nichcy.org/research/ee/learning-strategies/>

Effective Mathematics Instruction
<http://nichcy.org/research/ee/math>

Explicit Instruction
http://aim.cast.org/learn/historyarchive/backgroundpapers/explicit_instruction

Other *Research Summaries* like this one are available at NICHCY and include:

Direct Instruction
<http://nichcy.org/research/summaries/abstract1>

Peer-Mediated Intervention Studies on Academic Achievement for Students with EBD: A Review
<http://nichcy.org/research/summaries/abstract34>

Computer Assisted Instruction in Reading for Students with Learning Disabilities: A Research Synthesis | <http://nichcy.org/research/summaries/abstract46>

Effects of Instruction in Solving Mathematical Word Problems for Students with Learning Problems: A Meta-Analysis | <http://nichcy.org/research/summaries/abstract9>

Graphic Organizers and Their Effects on the Reading Comprehension of Students with LD: A Synthesis of Research
<http://nichcy.org/research/summaries/abstract21>

Abstracted from—

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