FOCUSED QUESTION
What is the evidence of effective interventions to promote occupational performance in school-age children with attention deficit hyperactivity disorder (ADHD)?


CLINICAL BOTTOM LINE:

Children diagnosed with attention deficit hyperactivity disorder (ADHD) can present with both behavioral and cognitive symptoms that interfere with occupational performance in school. Planning is considered an executive function, an aspect of cognition used to solve problems. Planning strategies can be taught to children in a variety of contexts to improve occupational performance in core academic subjects and other areas of occupation. In this study, teachers facilitated group discussions within class by using open-ended probing questions about the strategies the children used to complete math worksheets. Student-driven planning strategy instruction was effective compared to typical math instruction provided by math teachers within the regular curriculum.

School-based occupational therapists can employ student-driven planning strategies to complete academic assignments. The study also showed far transferability—the ability to apply learned strategies to similar tasks in the future—of the planning strategies at 1-year follow-up. These results provide support that this type of intervention is effective for long-term use. Improving the cognitive process of planning can teach children strategies that will promote occupational performance in school and other areas of occupation. This type of intervention can be used in individual and group occupational therapy sessions, as well as in consultation with teachers and administrators on program development.

Limitations of the study include: a small sample size, randomization was for classrooms rather than individuals, and math was the only subject for which the strategy was implemented. Future research needs that are relevant to occupational therapy include addressing the length of instruction time for effectiveness, generalization of the strategy use to other content areas, and most appropriate sequence of instruction.
RESEARCH OBJECTIVE(S)
List study objectives.

| Determine the effectiveness of a planning-based strategy instruction compared to regular math instruction for children with ADHD and learning disabilities (LD), as well as the far transferability of learned planning strategies. |

DESIGN TYPE AND LEVEL OF EVIDENCE:

| Level I: Randomized controlled trial, pretest–posttest, and 1-year follow-up design. |

Limitations (appropriateness of study design):
Was the study design type appropriate for the knowledge level about this topic? Circle yes or no, and if no, explain.

YES/NO The study design was appropriate for the knowledge level about the topic.

SAMPLE SELECTION
How were subjects selected to participate? Please describe.

| Parental consent was obtained for 74 students, and 29 subjects were selected to participate in the study. |

Inclusion Criteria

| Children diagnosed with ADHD and moderate to severe LD in reading, mathematics, or writing as determined by parental report; teacher report; multidisciplinary team reports; and/or school, medical, or psychological records. Children with comorbidities of depression or anxiety disorder were included in the study. |

Exclusion Criteria

| NR |

SAMPLE CHARACTERISTICS

| N = 29 |
| % Dropouts | NR |
| #/ (%) Male | 21 | #/ (%) Female | 8 |
| Ethnicity | Primarily Caucasian (89.7%) |
| Disease/disability diagnosis | ADHD and LD |

Check appropriate group:

| <20/study group | X 20–50/study group | 51–100/study group | 101–149/study group | 150–200/study group |

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### INTERVENTION(S) AND CONTROL GROUPS

*Add groups if necessary*

#### Group 1

| Brief Description | Children in the experimental group were randomly assigned by classroom. Math teachers for the experimental group received specific training prior to the intervention, and continuous feedback and observations were provided on a weekly basis. Students completed two math worksheets per day during math class for the duration of the study. During the seven baseline sessions, regular math instruction occurred, with subjects having 10 minutes to complete a math worksheet. The following 10 minutes consisted of unrelated discussions, and another math worksheet was completed during the final 10 minutes. During the 19 intervention sessions, delivered in the last 9.5 blocks, subjects completed a math worksheet in the first 10 minutes, had 10 minutes of group planning facilitation discussion to determine effective strategies used to complete the worksheet, and another math worksheet was completed during the last 10 minutes. During the intervention phase, subjects were not provided feedback about the strategies used during the completion of the first worksheet. Planning facilitation discussions were designed for self-reflection to assist children in recognizing the need for planning and employing effective strategies. Teachers facilitated the discussions using probes for children to identify and verbalize strategies for completing the math problems correctly. Lists of strategies were sometimes posted for children to employ. |
| Setting | Math classrooms within a private school for children with learning problems located in a large metropolitan area in the eastern United States |
| Who Delivered? | Math teachers |
| Frequency? | 13 daily blocks of 30-minute sessions (7 baseline, 19 intervention). Planning facilitation was 100 minutes total (10 minutes/day for 10 days) |
| Duration? | 3 weeks |

#### Group 2

| Brief Description | Children in the control group were randomly assigned by classroom and received regular math instruction. Students completed the same two math worksheets per day as the subjects in the experimental group for the duration of the study. The 30-minute blocks were set up the same way as in the experimental group, but during the second 10-minute instruction session, subjects in the control group received regular math instruction. This instruction varied depending on the teacher. |
| Setting | Math classrooms within a private school for children with learning problems located in a large metropolitan area in the eastern United States |
| Who Delivered? | Math teachers |
| Frequency? | 13 daily blocks of 30-minute sessions |
| Duration? | 3 weeks |
Intervention Biases: *Circle yes or no and explain, if needed.*

**Contamination**

YES/NO

**Co-intervention**

YES/NO 71.4% of subjects in the control group and 61.5% of subjects in the experimental group were on medication for ADHD. Due to the nature of the study setting, participants in both groups received psychological and related therapies that could have influenced results.

**Timing**

YES/NO

**Site**

YES/NO

Use of different therapists to provide intervention

YES/NO Different math teachers provided the intervention and control math instructions to both groups. In the intervention group, teachers received training on the program and continuous feedback to increase fidelity, but individual differences could have influenced results.

**MEASURES AND OUTCOMES**

Complete for each relevant measure when answering the evidence-based question:

Name of measure, what outcome was measured, whether the measure is reliable and valid (as reported in article – yes/no/NR [not reported]), and how frequently the measure was used.

The Cognitive Assessment System (CAS) measures intelligence based on the Planning, Attention, Simultaneous, and Successive (PASS) theory. The subtests used in this study:

- Planning: Matching Numbers and Planned Connections
- Attention: Expressive Attention and Number Detection
- Simultaneous: Nonverbal Matrices and Verbal Spatial Relations
- Successive: Word Series and Sentence Repetition

The Planning cognitive processes were used as the intervention basis in this study. Reliability and validity were not reported, although extensive research has been conducted. The CAS measures were completed at pre and post intervention.

Name of measure, what outcome was measured, whether the measure is reliable and valid (as reported in article – yes/no/NR [not reported]), and how frequently the measure was used.

The Woodcock-Johnson Tests of Achievement, Third Edition (WJ-III ACH) Math Fluency Subtest measures students math fluency in addition, subtraction, and multiplication. The test is typically delivered individually but was administered to groups at pre and post intervention. The
WJ-III ACH was also administered at 1-year post-intervention. The WJ-III was used to determine how well subjects were able to transfer strategies used on the worksheets to other measures of math. Reliability and validity were not reported in the study, but can be found within the WJ-III Technical Manual.

Name of measure, what outcome was measured, whether the measure is reliable and valid (as reported in article – yes/no/NR [not reported]), and how frequently the measure was used.

The Wechsler Individual Achievement Test, Second Edition (WIAT-II) Numerical Operations subtest was used to measure students’ ability to solve written calculation problems and simple equations (addition, subtraction, multiplication, and division). The first 7 items were discarded for the purpose of this study. The WIAT-II was used to determine how well subjects were able to transfer strategies used on the worksheets to other measures of math. The subtest was administered to the group at pre and post intervention. Reliability and validity were not reported in the study, but can be found within the WIAT-II Examiner’s Manual.

Measurement Biases
Were the evaluators blind to treatment status? Circle yes or no, and if no, explain.

YES/NO The teachers and evaluators were aware of the treatment groups in order to provide the proper intervention/instruction and complete data analysis.

Recall or memory bias. Circle yes or no, and if yes, explain.

YES/NO

Others (list and explain):

N/A

RESULTS
List results of outcomes relevant to answering the focused questionInclude statistical significance where appropriate (p < 0.05)
Include effect size if reported

- Baseline and intervention scores were obtained for each subject by taking the average score of the first 7 worksheets and the average score of the 19 intervention worksheets.
- Group effect size of 0.2 was small, 0.5 was medium, and 0.8 was large.
- There was a significant difference on the average of CAS Planning scores compared to the other scores on the CAS (p ≤ 0.05).
- No significant differences between groups were found on the four PASS scales.
- A large effect size was shown for the experimental group on the math worksheets scores between pre and post intervention (ES = 0.85).
- Subjects in the comparison group showed a small effect size on the math worksheets between pre and post intervention (ES = 0.26).
- The experimental group showed significant differences between pre and post intervention scores on the WJ-III ACH Math Fluency subscale (ES = 1.17) and the WIAT-II Numerical Operations (ES = 0.40). Group effect sizes were small for the control group on the math
worksheets (ES=0.26), WJ-III ACH Math Fluency (ES = 0.09), and WIAT-II Numerical Operations (ES = −0.14).

- Subjects in the experimental group demonstrated significant improvements on all three measures compared to the control group ($p \leq .05$).
- There was a univariate effect ($p \leq .05$) that the planning strategy was more beneficial for students in the experimental group that the regular math instruction in the control group.
- Subjects in the experimental group significantly improved more on far transferability of math strategies than the control group (WJ-III ACH Math Fluency $p \leq .05$, WIAT-II Numerical Operations $p < .01$).
- Twenty-seven students participated in the WJ-III ACH Math Fluency subscale test at 1-year follow-up. Results showed that subjects in the experimental group showed significant improvement (ES = 0.85) compared with subjects in the control group (ES = 0.09).

Was this study adequately powered (large enough to show a difference)? Circle yes or no, and if no, explain.

**YES**  NO

Were appropriate analytic methods used? Circle yes or no, and if no, explain.

**YES**  NO

Were statistics appropriately reported (in written or table format)? Circle yes or no, and if no, explain.

**YES**  NO

**CONCLUSIONS**

State the authors’ conclusions that are applicable to answering the evidence-based question.

The authors concluded that children with ADHD improved significantly more on math worksheets and standardized math tests when taught to utilize planning strategies than children taught using traditional math instruction procedures. The planning strategies were effective despite the limited amount of time it took to implement (10 minutes).

The authors propose several future research studies based on the results of the current study, including:

- Comparing strategy approaches to comorbidities and medication use
- Comparing planning strategy methods to direct strategy approaches
- Using planning strategy in other content areas
- Generalization of the planning strategy to other content areas
- Length of instruction time to effectiveness
- Determine the best sequence for instruction
- Benefit of implementing planning strategy instruction into regular curriculum.
This work is based on the evidence-based literature review completed by Shannon Zigenfus, OTS, and Carmela Battaglia, PhD, OTR/L, Faculty Advisor, Keuka College.


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