WWC Single Study Review

A review of the design and summary of findings for an individual study

ies INSTITUTE OF EDUCATION SCIENCES

November 2015

WWC Review of the Report "Closing the Achievement Gap Through Modification of Neurocognitive and Neuroendocrine Function: Results from a Cluster Randomized Controlled Trial of an Innovative Approach to the Education of Children in Kindergarten"[1,2]

The findings from this review do not reflect the full body of research evidence on *Tools of the Mind*.

What is this study about?

The study authors examined whether *Tools of the Mind* increased academic achievement, cognitive flexibility, working memory, attention control, and cognitive processing speed for kindergarten students. This intervention is a pedagogical approach that emphasizes teacher-led interactions between classmates. The program is based on the idea that students' "executive function," or self-regulation, is the main mechanism by which they can increase learning.

The study authors randomly assigned 29 schools in 12 school districts to either implement the *Tools of the Mind* program during the kindergarten year for 2 consecutive years or to a comparison group that did not implement a similar program.[3] Up to six students per class were assessed on the outcome measures at the beginning of the kindergarten year (baseline), at the end of the kindergarten year, and at the beginning of first grade. When students participating in the study did not complete follow-up assessments, the study included other students who had been wait-listed or were additionally recruited at follow-up. With these students, a total of 759 kindergarteners were included in the analyses.

The authors assessed the impacts of *Tools of the Mind* by comparing the intervention and comparison group on measures of academic achievement in mathematics, alphabetics, comprehension, cognitive flexibility, working memory, attention control, and cognitive processing speed.

Features of *Tools of the Mind*

Tools of the Mind is a curriculum that aims to promote cognitive and academic outcomes for kindergarten students by focusing on "executive function" as the central process to the development of students' academic and social competencies. *Tools of the Mind* is based on the ideas of Russian psychologist Lev Vygotsky. Instruction is individualized through teacher scaffolding, and dramatic play is a main component of the curriculum. Teachers meet with students weekly to develop individualized learning plans and to review and critique work. Teachers then provide instruction using interactions among classmates. The curriculum includes math, literacy, and science activities that align with Common Core standards. Professional development for teachers and paraprofessionals are provided by *Tools of the Mind* staff during the first 2 years of implementation.

What did the study find?

None of the analyses presented in this study meet WWC group design standards and therefore, the study findings are not presented in this WWC report.

WWC Rating

The research described in this report does not meet WWC group design standards

Some students in the analytic sample joined the study as a second cohort in the year after random assignment had occurred. As a result, the analytic sample included non-randomly assigned joiners in both the intervention and comparison groups. Therefore, baseline equivalence is required for the study to meet WWC group design standards with reservations. Baseline equivalence could not be demonstrated for the analytic sample because baseline data are not available for joiners. Methods of accounting for missing data on baseline outcome measures can only be used for randomized controlled trials with low attrition.[4] For this reason, the study is rated does not meet WWC group design standards and therefore, the findings from this study are not presented in this WWC report.

Endnotes

[1] Blair, C., & Raver, C. C. (2014). Closing the achievement gap through modification of neurocognitive and neuroendocrine function: Results from a cluster randomized controlled trial of an innovative approach to the education of children in kindergarten. *PloS ONE, 9*(11), e112393. doi:10.1371/journal.pone.0112393

[2] Single study reviews examine evidence published in a study (supplemented, if necessary, by information obtained directly from the authors) to assess whether the study design meets WWC design standards. The review reports the WWC's assessment of whether the study meets WWC design standards and summarizes the study findings following WWC conventions for reporting evidence on effectiveness. This study was reviewed using the single study review protocol (version 2.0). A quick review of this study was released in February 2015, and this report is the follow-up review that replaces that initial assessment. This review includes additional information on the study design that was obtained from the authors after the quick review was released.

[3] In two districts, all kindergarten classrooms were in a single school, so the team randomly assigned classrooms instead of schools and treated the single schools as separate classrooms in the analysis.

[4] The study used a statistical technique referred to as Full-Information Maximum Likelihood to include students with missing baseline data in the analysis. Baseline equivalence cannot be demonstrated on an analytic sample that includes missing data. No analyses were reported that were based only on complete cases.

Recommended Citation

U.S. Department of Education, Institute of Education Sciences, What Works Clearinghouse. (2015, November). *WWC review of the report: Closing the achievement gap through modification of neurocognitive and neuroendocrine function: Results from a cluster randomized controlled trial of an innovative approach to the education of children in kindergarten.* Retrieved from http://whatworks.ed.gov

Glossary of Terms

Attrition Attrition occurs when an outcome variable is not available for all participants initially assigned to the intervention and comparison groups. The WWC considers the total attrition rate and the difference in attrition rates across groups within a study.

Clustering adjustment If intervention assignment is made at a cluster level and the analysis is conducted at the student level, the WWC will adjust the statistical significance to account for this mismatch, if necessary.

Confounding factor A confounding factor is a component of a study that is completely aligned with one of the study conditions, making it impossible to separate how much of the observed effect was due to the intervention and how much was due to the factor.

Design The design of a study is the method by which intervention and comparison groups were assigned.

Domain A domain is a group of closely related outcomes.

Effect size The effect size is a measure of the magnitude of an effect. The WWC uses a standardized measure to facilitate comparisons across studies and outcomes.

Eligibility A study is eligible for review if it falls within the scope of the review protocol and uses either an experimental or matched comparison group design.

Equivalence A demonstration that the analytic sample groups are similar on observed characteristics defined in the review area protocol.

Improvement index Along a percentile distribution of individuals, the improvement index represents the gain or loss of the average individual due to the intervention. As the average individual starts at the 50th percentile, the measure ranges from –50 to +50.

Multiple comparison adjustment When a study includes multiple outcomes or comparison groups, the WWC will adjust the statistical significance to account for the multiple comparisons, if necessary.

Quasi-experimental design (QED) A quasi-experimental design (QED) is a research design in which study participants are assigned to intervention and comparison groups through a process that is not random.

Randomized controlled trial (RCT) A randomized controlled trial (RCT) is an experiment in which eligible study participants are randomly assigned to intervention and comparison groups.

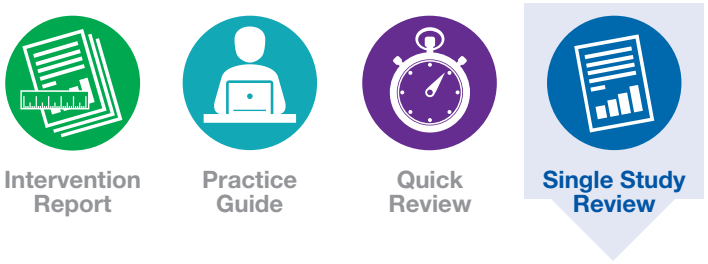
Single-case design (SCD) A research approach in which an outcome variable is measured repeatedly within and across different conditions that are defined by the presence or absence of an intervention.

Standard deviation The standard deviation of a measure shows how much variation exists across observations in the sample. A low standard deviation indicates that the observations in the sample tend to be very close to the mean; a high standard deviation indicates that the observations in the sample are spread out over a large range of values.

Statistical significance Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups. The WWC labels a finding statistically significant if the likelihood that the difference is due to chance is less than 5% ($p < .05$).

Substantively important A substantively important finding is one that has an effect size of 0.25 or greater, regardless of statistical significance.

Please see the WWC Procedures and Standards Handbook (version 3.0) for additional details.



A **single study review** of an individual study includes the WWC's assessment of the quality of the research design and technical details about the study's design and findings.

This single study review was prepared for the WWC by Mathematica Policy Research under contract ED-IES-13-C-0010.