ST Math

Nonregulatory ESSA Standards Evidence Review & What Works Clearinghouse Standards Review

ESSA (Every Student Succeeds Act) Evidence Level	**Moderate (Tier 2):** SRI review indicates there is at least one well-designed and well-implemented quasi-experimental study on the intervention indicating positive effects.
WWC (What Works Clearinghouse) Standards	**Meets Evidence Standards with Reservations:** SRI review indicates the study fulfills the design, analytic, and technical requirements of WWC v4.0 Group Design Standards.
Study report reviewed	Wendt, S., Rice, J., & Nakamoto, J. (2019). *A cross-state evaluation of MIND Research Institute's ST Math program and math performance.* Los Alamitos, CA: WestEd. Retrieved from: https://www.wested.org/wp-content/uploads/2019/07/ST-Math-Evaluation-Report-June-2019.pdf
Provider	**MIND Research Institute.** More information can be found at https://www.mindresearch.org/ and at https://www.stmath.com/

MIND Research Institute contracted with SRI Education for an independent review of a quasi-experimental study WestEd conducted in partnership with MIND: "A Cross-State Evaluation of MIND Research Institute's ST Math Program and Math Performance."

The study authors conducted multiple analyses to investigate the extent to which use of Spatial-Temporal (ST) Math in grades 3–5 was associated with increased school mathematics achievement. Considering the intent-to-treat analyses of the full analytic sample across grades 3 through 5 to be the main analyses, SRI focused its review on them. We encourage readers to review the study report for detailed information on all analyses and findings.

ST Math Description

ST Math is a preK–8 visual instructional program that leverages students' spatial-temporal reasoning ability to solve mathematical problems. ST Math begins visually and then gradually introduces traditional symbols and language as students master mathematical concepts. In the ST Math puzzles, a variety of visual models are used to present math concepts in nonroutine ways, and the animated informative feedback adapts to a student's response.

ST Math is designed to be a supplemental mathematics curriculum, integrated into classroom instruction. MIND recommends that K–1 students have two 30-minute sessions of ST Math per week and students in grades 2 and above have two 45-minute sessions.

MIND provides educators with training in implementing the ST Math program, an introduction to the neuroscience behind the program's design, and guidance on effective use of the program's data and report features. Additional educator trainings are available on facilitation and engagement strategies, developing classroom culture, deepening content knowledge, promoting mathematical discourse, and more. Trainings are offered both on site at schools and online.

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1 As displayed in Exhibit 4, p. 12, of the study report.

Study Sample

The authors identified treatment schools for this study using three criteria: (1) Schools must be actively using ST Math at least one grade level in grades 3–5 during the 2015–16 school year; (2) schools must have used ST Math for either 1, 2, or 3 consecutive years; and (3) outcome and baseline data must be readily available.

The unit of analysis was the aggregate performance of grade-level clusters within schools. For example, one treatment analysis unit would be the aggregate performance of all third-graders within School X using ST Math. A total of 1,132 grade-level clusters were identified for the treatment sample: 392 third-grade clusters, 366 fourth-grade clusters, and 374 fifth-grade clusters. Schools were drawn from 16 states: California, Colorado, Connecticut, Florida, Georgia, Iowa, Massachusetts, Michigan, Minnesota, Missouri, Nevada, New Jersey, New York, Texas, Virginia, and Wisconsin.

Comparison grade-level clusters were identified using matching at the grade-level cluster within each state. The authors allowed different grade-level clusters within a given treatment school to be matched with grade-level clusters across multiple comparison schools. Matching was conducted using a one-to-many approach, and frequency weights were used across all analyses to establish equal group sizes. The authors used appropriate time spans for baseline years to account for differences in the amount of time ST Math was used in treatment schools. For example, a treatment grade-level cluster using ST Math for 3 years would have the 2012–13 school year serve as its baseline achievement year, as would the comparison grade-level cluster it was matched with. Baseline equivalence was established through the matching process in accordance with WWC v4.0 Group Design Standards.

Authors' Findings

The authors selected two outcomes of interest for study: average scale scores and percent proficient rates on state standardized mathematics assessments. The authors applied multiple comparison corrections for their main findings.

On both outcomes, grade-level clusters using ST Math performed significantly better in mathematics than similar grade-level clusters not using the program. As measured by average scale scores on state standardized mathematics assessments, the authors found a positive effect size of .13. As measured by percent proficient rates on state standardized mathematics assessments, the authors found a positive effect size of .17.

Considerably larger positive effects were found in reduced analytic samples of grade-level clusters implementing ST Math according to specific fidelity metrics.

Evidence Justification

SRI determined that this study provides **moderate evidence** for ST Math efficacy in grades 3–5 according to Every Student Success Act (ESSA) levels of evidence provided by the U.S. Department of Education guidelines[2] for the following reasons:

- The multiple members of the SRI review team who were WWC-certified reviewers[3] assessed the study as fulfilling the design, analytic, and technical requirements for Meets Evidence Standards with Reservations. This is sufficient for

Strong Evidence
(well-designed, well-implemented experimental study)

Moderate Evidence
(well-designed, well-implemented quasi-experimental study)

Promising Evidence
(correlational study with statistical controls for selection bias)

Demonstrates a Rationale
(research-informed theory of action)

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2 The department's Non-Regulatory Guidance: Using Evidence to Strengthen Education Investments, https://ed.gov/policy/elsec/leg/essa/guidanceuseseinvestment.pdf, gives definitions of the levels of evidence.

3 They successfully completed the WWC training modules and a performance assessment covering the design, analysis, and technical concepts and standards required for performing WWC reviews of randomized controlled trial and quasi-experimental design studies in education.

the study to be considered a "well-designed and well-implemented quasi-experimental study" for the purposes of fulfilling ESSA evidence criteria.

- The study showed statistically significant and positive (*i.e.,* favorable) effects of ST Math on multiple student outcomes of interest.
- The study has a large and multisite sample. An analytic sample is considered to be "large" for this purpose if it consists of 350 or more individual students or 50 or more groups each containing 10 or more students. An analytic sample is considered to be "multisite" for this purpose if is consists of more than one local education agency, locality, or state.
- The study has a sample overlapping with relevant populations and settings proposed to receive the intervention.

SRI did not conduct a literature review or scan of evidence related to ST Math's effects on student achievement. Therefore, we cannot fully assess whether the study is overridden by other evidence indicating a significant unfavorable effect of ST Math on student mathematics achievement. Our assessment of moderate evidence assumes no such unfavorable evidence exists.

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