



WWC Intervention Report

A summary of findings from a systematic review of the evidence



Primary Mathematics

Updated December 2015

Singapore Math®

This intervention report presents findings from a systematic review of *Singapore Math*® conducted using the What Works Clearinghouse (WWC) Procedures and Standards Handbook, version 3.0, and the Primary Mathematics review protocol, version 3.1. No studies of *Singapore Math*® that fall within the scope of the Primary Mathematics review protocol meet WWC group design standards. Because no studies meet WWC group design standards at this time, the WWC is unable to draw any conclusions based on research about the effectiveness or ineffectiveness of *Singapore Math*® on the achievement of primary students in kindergarten through grade 8. Research that meets WWC design standards is needed to determine the effectiveness or ineffectiveness of this intervention.

Program Description¹

Singapore Math® is a collection of mathematics curricula developed by Singapore's Ministry of Education and private textbook publishers for use in Singapore schools. *Singapore Math*® is comprised of Kindergarten Mathematics, Primary Mathematics for students in grades 1–6, and Dimensions Mathematics for students in grades 7–8. The program is centered on problem solving, emphasizes computational skills, and focuses on conceptual understanding and strategic thinking. With these three components, *Singapore Math*® aims to provide more in-depth coverage of a relatively smaller number of topics than typical mathematics textbooks. *Singapore Math*® emphasizes problem-based development of mathematical concepts and uses concrete illustrations to show how to solve multistep problems. The content framework covers topics in increasingly advanced detail in successive grades.

Research²

The WWC identified 17 studies of *Singapore Math*® for primary students that were published or released between 1983 and 2014.

Three studies are within the scope of the Primary Mathematics review protocol but do not meet WWC group design standards.

- Two studies used a quasi-experimental design (QED) to assess the effects of *Singapore Math*®, but neither study established baseline equivalence between the intervention and comparison groups as required by WWC group design standards.
- One study used a randomized controlled trial (RCT) to assess the effects of *Singapore Math*®. However, the analysis included students who entered study classrooms (non-randomly) after random assignment occurred, and the study did not establish baseline equivalence between the analytical intervention and comparison groups as required by WWC group design standards.

Ten studies are out of the scope of the Primary Mathematics review protocol because they have an ineligible study design. These include studies without comparison groups or literature reviews or other publications that are not primary analyses of the effectiveness of *Singapore Math*®.

Four studies are out of the scope of the Primary Mathematics review protocol for reasons other than study design. These include studies that did not examine a relevant outcome domain specified in the protocol—specifically, they did not examine outcomes on student mathematics achievement. Instead, studies examined other types of outcomes, such as ones related to curriculum implementation or teacher practices.

References

Studies that do not meet WWC group design standards

- Blalock, J. T. (2011). *The impact of Singapore Math® on student knowledge and enjoyment in mathematics* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 3492479) The study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.
- Goldman, M. R., Retakh, V., Rubin, R. A., & Minnigh, H. A. (2009). *The effect of Singapore Mathematics® on student proficiency in a Massachusetts school district: A longitudinal statistical examination*. Report by the Gabriella and Paul Rosenbaum Foundation. The study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.
- Merchlinsky, S., & Wolanin, N. (2003). *Evaluation of the Singapore Math Pilot Program: Year 2 Report of Findings*. Rockville, MD: Office of Shared Accountability, Montgomery County Public Schools. The study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.
- Additional source:**
- Gross, S., & Merchlinsky, S. (2002). *Evaluation of the Singapore Math Pilot Program: Year 1 Report of Findings*. Rockville, MD: Office of Shared Accountability, Montgomery County Public Schools.

Studies that are ineligible for review using the Primary Mathematics Evidence Review Protocol

- Adams, L. M., Tung, K. K., Warfield, V. M., Knaub, K., Yong, D., & Mudavanhu, B. (2002). *Middle school mathematics comparisons for Singapore Mathematics®, Connected Mathematics Program, and Mathematics in Context (including comparisons with the NCTM Principles and Standards 2000)*. Retrieved from <http://www.amath.washington.edu/> This study is ineligible for review because it does not use an eligible design.
- Badger, J. (2013). Teaching Singapore Math®: Evaluating measures to effectively teach and implement a new mathematics curriculum in 21 elementary schools. *GATEways to Teacher Education*, 14(1), 23–41. This study is ineligible for review because it is out of scope of the protocol.
- Darroch, B. J. (2009). Exemplary project: Singapore Math®: Action research on a curriculum change, student achievement, and teacher efficacy. In R. A. Schmuck (Ed.), *Practical action research: A collection of articles (second edition)* (p. 96). Thousand Oaks, CA: Corwin Press. This study is ineligible for review because it does not use an eligible design.
- Desimone, L., Smith, T., Baker, D., & Ueno, K. (2006). Assessing barriers to the reform of United States mathematics instruction from an international perspective. *American Educational Research Journal*, 42(3), 501–535. This study is ineligible for review because it is out of scope of the protocol.
- Ezarik, M. (2005). Lessons to learn: U.S. vs. Singapore Math®. *District Administration*, 41(5), 70. This study is ineligible for review because it does not use an eligible design.
- Fan, L., & Zhu, Y. (2007). From convergence to divergence: The development of mathematical problem solving in research, curriculum, and classroom practice in Singapore. *ZDM—The International Journal on Mathematics Education*, 39(5), 491–501. This study is ineligible for review because it is out of scope of the protocol.
- Garelick, B. (2006). A tale of two countries and one school district. *Nonpartisan Education Review/Essays*, 2(9). Retrieved from <http://www.thirdeeducationgroup.org/> This study is ineligible for review because it does not use an eligible design.
- Garelick, B. (2006). Miracle Math. *Education Next*, 6(4), 38–45. This study is ineligible for review because it does not use an eligible design.
- Ginsburg, A., Leinwand, S., Anstrom, T., & Pollock, E. (2005). *What the United States can learn from Singapore's world-class mathematics system (and what Singapore can learn from the United States): An exploratory study*.

- Washington, DC: American Institutes for Research. <http://files.eric.ed.gov/fulltext/ED491632.pdf>. This study is ineligible for review because it does not use an eligible design.
- Ho, K. F., & Hedberg, J. G. (2005). Teachers' pedagogies and their impact on students' mathematical problem solving. *Journal of Mathematical Behavior*, 24(3–4), 238–252. This study is ineligible for review because it does not use an eligible design.
- Leinwand, S., & Ginsburg, A. L. (2007). Learning from Singapore Math®. *Educational Leadership*, 65(3), 32–36. This study is ineligible for review because it does not use an eligible design.
- Mahoney, K. (2012). *Effects of Singapore's Model Method on elementary student problem solving performance: Single subject research* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 1316620279) This study is ineligible for review because it is out of scope of the protocol.
- Powell, T. L. (2014). *A comparative analysis of the Singapore Math® curriculum and the Everyday Mathematics curriculum on fifth grade achievement in a large northeastern urban public school district* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 1564756065) This study is ineligible for review because it does not use an eligible design.
- Waight, M. M. (2006). *The implementation of Singapore Mathematics® in a regional school district in Massachusetts 2000–2006: Remarks to National Mathematics Advisory Panel*. Cambridge, MA. This study is ineligible for review because it does not use an eligible design.

Endnotes

¹ The descriptive information for this program was obtained from a publicly available source: the program's website (<http://www.singaporemath.com>, downloaded July 2014). The WWC requests developers to review the program description sections for accuracy from their perspective. The program description was provided to the developer in August 2014, and the WWC incorporated feedback from the developer. Further verification of the accuracy of the descriptive information for this program is beyond the scope of this review.

² The literature search reflects documents publicly available by December 2014. The previous report was released under the Middle School Math topic area in April 2009. This report has been updated to include reviews of seven studies that were not reviewed in the previous report. Of the additional studies, four used an ineligible study design or were out of the scope of the protocol, and three were within the scope of the protocol but did not meet WWC group design standards. A complete list and disposition of all studies reviewed are provided in the references. The studies in this report were reviewed using the Standards from the WWC Procedures and Standards Handbook (version 3.0), along with those described in the Primary Mathematics review protocol (version 3.1). The evidence presented in this report is based on available research. Findings and conclusions may change as new research becomes available.

Recommended Citation

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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 and inclusion in this report 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 analysis sample groups are similar on observed characteristics defined in the review area protocol.
Extent of evidence	An indication of how much evidence supports the findings. The criteria for the extent of evidence levels are given in the WWC Procedures and Standards Handbook (version 3.0).
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.
Intervention	An educational program, product, practice, or policy aimed at improving student outcomes.
Intervention report	A summary of the findings of the highest-quality research on a given program, product, practice, or policy in education. The WWC searches for all research studies on an intervention, reviews each against design standards, and summarizes the findings of those that meet WWC design standards.
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.
Rating of effectiveness	The WWC rates the effects of an intervention in each domain based on the quality of the research design and the magnitude, statistical significance, and consistency in findings. The criteria for the ratings of effectiveness are given in the WWC Procedures and Standards Handbook (version 3.0).
Single-case design	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.

Glossary of Terms

- 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 tend to be 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.
- Systematic review** A review of existing literature on a topic that is identified and reviewed using explicit methods. A WWC systematic review has five steps: 1) developing a review protocol; 2) searching the literature; 3) reviewing studies, including screening studies for eligibility, reviewing the methodological quality of each study, and reporting on high quality studies and their findings; 4) combining findings within and across studies; and, 5) summarizing the review.

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



An **intervention report** summarizes the findings of high-quality research on a given program, practice, or policy in education. The WWC searches for all research studies on an intervention, reviews each against evidence standards, and summarizes the findings of those that meet standards.

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