



# WWC Intervention Report

A summary of findings from a systematic review of the evidence



Secondary Mathematics

Updated December 2017

## Accelerated Math®

This intervention report presents findings from a systematic review of *Accelerated Math*® conducted using the WWC Procedures and Standards Handbook (version 3.0) and the Secondary Mathematics review protocol (version 3.1). No studies of *Accelerated Math*® that fall within the scope of the Secondary Mathematics review protocol meet What Works Clearinghouse (WWC) group design standards. Because no studies meet WWC design standards at this time, the WWC is unable to draw any conclusions based on research about the effectiveness or ineffectiveness of *Accelerated Math*® on the mathematics achievement of secondary students, who are typically in grades 9–12. Research that meets WWC design standards is necessary to determine the effectiveness or ineffectiveness of this intervention.

### Intervention Description<sup>1</sup>

*Accelerated Math*®, published by Renaissance Learning, is a software tool that provides practice problems for students in grades K–12 and provides teachers with reports to monitor student progress. *Accelerated Math*® creates individualized student assignments, scores the assignments, and generates reports on student progress. The software is typically used with the math curriculum being used in the classroom to add practice for students and help teachers differentiate instruction through the program's progress-monitoring data. This review focuses on studies of *Accelerated Math*®'s secondary mathematics content, which includes Algebra I, Geometry, and Algebra II.

### Research<sup>2,3</sup>

The WWC identified 80 studies of *Accelerated Math*® that were published or released between 1983 and 2017.

Four studies are within the scope of the Secondary Mathematics review protocol but do not meet WWC group design standards (see the Glossary of Terms in this document for a definition of this term and other commonly used research terms).

- One study was a randomized controlled trial in which the combination of overall and differential attrition rates exceeds WWC standards for this area, and the equivalence of the analytic intervention and comparison groups at baseline was necessary, but not demonstrated (Lambert & Algozzine, 2009).
- One study was a randomized controlled trial in which the random assignment was jeopardized, and the equivalence of the analytic intervention and comparison groups at baseline was necessary, but not demonstrated (Ysseldyke & Tardrew, 2007).
- One study was a randomized controlled trial in which the measures of effectiveness could not be attributed solely to the intervention because there was only one intervention classroom (Springer et al., 2007).
- One study used a quasi-experimental design and did not demonstrate equivalence of the analytic sample (Renaissance Learning, 2017).

Eight studies are out of the scope of the Secondary Mathematics review protocol because they have an ineligible study design.

Sixty-eight studies are out of the scope of the Secondary Mathematics review protocol for reasons other than study design.

### References

#### Studies of *Accelerated Math*<sup>®</sup> Algebra that meet WWC group design standards without reservations

None.

#### Studies of *Accelerated Math*<sup>®</sup> Algebra that meet WWC group design standards with reservations

None.

#### Studies of *Accelerated Math*<sup>®</sup> Algebra that do not meet WWC group design standards

Lambert, R., & Algozzine, B. (2009). *Accelerated Math evaluation report* (Middle school sample). Charlotte: Center for Educational Measurement and Evaluation, University of North Carolina at Charlotte. 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:**

Lambert, R., Algozzine, B., & McGee, J. (2014). Effects of progress monitoring on math performance of at-risk students (Middle school sample). *British Journal of Education, Society and Behavioural Science*, 4(4), 527–540.

Renaissance Learning, Inc. (2017). *Special report: Trends in student outcome measures: The role of individualized math practice*. Wisconsin Rapids, WI: Author. The study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Springer, R. M., Pugalee, D., & Algozzine, B. (2007). Improving mathematics skills of high school students. *Clearing House: A Journal of Educational Strategies, Issues and Ideas*, 81(1), 37–44. Retrieved from <https://eric.ed.gov/?id=EJ781748> The study does not meet WWC group design standards because the measures of effectiveness cannot be attributed solely to the intervention.

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Semones, M., & Springer, R. M. (2005). *Struggling high school students using Accelerated Math pass AIMS test*. Wisconsin Rapids, WI: Renaissance Learning, Inc.

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Ysseldyke, J. E., Tardrew, S. P., Betts, J., Thill, T., & Hannigan, E. (2004). Use of an instructional management system to enhance math instruction of gifted and talented students. *Journal for the Education of the Gifted*, 27(4), 293–310. Retrieved from <https://eric.ed.gov/?id=EJ682720>

#### Studies of *Accelerated Math*<sup>®</sup> Geometry that meet WWC group design standards

None.

#### Studies of *Accelerated Math*<sup>®</sup> Geometry that do not meet WWC group design standards

None.

### Studies of *Accelerated Math*® Algebra II that meet WWC group design standards

None.

### Studies of *Accelerated Math*® Algebra II that do not meet WWC group design standards

None.

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- Bach, S. (2001). *An evaluation of Accelerated Math in a seventh grade classroom*. Wisconsin Rapids, WI: Renaissance Learning, Inc. The study is ineligible for review because it is out of the scope of the protocol.
- Beyer, R. (2008). *Curriculum-based monitoring with diagnostic analysis: A fourth grade homework intervention* (Unpublished doctoral dissertation). Saint Mary's University of Minnesota, Minneapolis. The study is ineligible for review because it does not use a sample aligned with the protocol.
- Boys, C. J. (2003). *Mastery orientation through task-focused goals: Effects on achievement and motivation* (Unpublished doctoral dissertation). University of Minnesota, Minneapolis. The study is ineligible for review because it does not use a sample aligned with the protocol.
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Zumwalt, D. B. (2001). *The effectiveness of computer-aided instruction in eighth-grade pre-algebra classrooms in Idaho* (Unpublished doctoral dissertation). Idaho State University, Pocatello. The study is ineligible for review because it does not use a sample aligned with the protocol.

### Endnotes

<sup>1</sup> The descriptive information for this intervention comes from a publicly available source—the developer’s website ([www.renaissance.com](http://www.renaissance.com), downloaded May 2017). The WWC provided the developer with the intervention description in May 2017 and asked the developer to review it for accuracy from its perspective. The WWC subsequently incorporated feedback from the developer. Further verification of the accuracy of the descriptive information for this intervention is beyond the scope of this review.

<sup>2</sup> The WWC previously released reports on *Accelerated Math*<sup>®</sup> under the Elementary School Mathematics (ESM) topic area in September 2010, the Middle School Mathematics (MSM) topic area in September 2008, and the High School Mathematics (HSM) topic area in July 2011. The WWC prepared the reports using the WWC Procedures and Standards Handbook (version 1.0 for the MSM report, and version 2.0 for the ESM and HSM reports) and the specific topic area review protocols (ESM version 1.1, MSM version 1.0, and HSM version 2.0). In June 2015, the WWC restructured the reviews of research on math interventions into two areas instead of three. These two review areas are Primary Mathematics (which includes interventions in which math is presented through multi-topic materials and curricula, typically used in grades K–8), and Secondary Mathematics (which includes interventions organized by math content area [e.g., algebra, geometry, and calculus], typically taught in grades 9–12). These two areas replaced the prior ESM, MSM, and HSM topic areas, which were organized by student grade level. The WWC is updating and replacing intervention reports written under the prior topic areas.

The literature search reflects documents publicly available by February 2017. This updated report includes reviews of 41 studies that the previous WWC intervention reports did not include. Of the additional studies, 39 were not within the scope of the protocol and 2 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 current report, which includes reviews of all previous studies that met WWC group design standards with reservations or did not meet WWC group design standards in the MSM and HSM reports, resulted in a revised disposition for five studies.

Gaeddert (2001) and Hongerholt (2006) are ineligible for review in this report, whereas they were previously rated does not meet WWC group design standards in the HSM intervention report. In both cases, the change in rating was due to a change in the procedures for review under the WWC Procedures and Standards Handbook (version 3.0), whereby master’s theses are no longer eligible for review.

Ysseldyke and Bolt (2007) and Nunnery and Ross (2007) were previously rated as meet WWC group design standards with reservations in the MSM intervention report. These two studies are now rated as ineligible for the Secondary Mathematics intervention report. The current dispositions differ due to different eligibility requirements under the Secondary Mathematics topic area. Ysseldyke and Bolt (2007) conducted analyses on a pooled sample that included pre-Algebra and Algebra students, and the Nunnery and Ross (2007) study examined a pre-Algebra sample.

Ysseldyke and Tardrew (2007) is rated does not meet WWC group design standards in this report, whereas it had previously received a rating of meets WWC group design standards with reservations in the MSM intervention report. The current rating differs from the prior MSM review because the current review focuses on the grades 9 and 10 analytic sample, rather than grades 6–8, and equivalence of the analytic sample was necessary but was not demonstrated. The current rating is consistent with the rating in the prior HSM intervention report (which also reviewed grades 9 and 10).

<sup>3</sup> Reviews of studies in this report used the standards from the WWC Procedures and Standards Handbook (version 3.0) and the Secondary 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.

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### Glossary of Terms

**Attrition** Attrition occurs when an outcome variable is not available for all subjects initially assigned to the intervention and comparison groups. If a randomized controlled trial (RCT) or regression discontinuity design (RDD) study has high levels of attrition, the validity of the study results can be called into question. An RCT with high attrition cannot receive the highest rating of *Meets WWC Group Design Standards without Reservations*, but can receive a rating of *Meets WWC Group Design Standards with Reservations* if it establishes baseline equivalence of the analytic sample. Similarly, the highest rating an RDD with high attrition can receive is *Meets WWC RDD Standards with Reservations*.

For single-case design research, attrition occurs when an individual fails to complete all required phases or data points in an experiment, or when the case is a group and individuals leave the group. If a single-case design does not meet minimum requirements for phases and data points within phases, the study cannot receive the highest rating of *Meets WWC Pilot Single-Case Design Standards without Reservations*.

**Baseline** A point in time before the intervention was implemented in group design research and in regression discontinuity design studies. When a study is required to satisfy the baseline equivalence requirement, it must be done with characteristics of the analytic sample at baseline. In a single-case design experiment, the baseline condition is a period during which participants are not receiving the intervention.

**Clustering adjustment** An adjustment to the statistical significance of a finding when the units of assignment and analysis differ. When random assignment is carried out at the cluster level, outcomes for individual units within the same clusters may be correlated. When the analysis is conducted at the individual level rather than the cluster level, there is a mismatch between the unit of assignment and the unit of analysis, and this correlation must be accounted for when assessing the statistical significance of an impact estimate. If the correlation is not accounted for in a mismatched analysis, the study may be too likely to report statistically significant findings. To fairly assess an intervention's effects, in cases where study authors have not corrected for the clustering, the WWC applies an adjustment for clustering when reporting statistical significance.

**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 method by which intervention and comparison groups are assigned (group design and regression discontinuity design) or the method by which an outcome measure is assessed repeatedly within and across different phases that are defined by the presence or absence of an intervention (single-case design). Designs eligible for WWC review are randomized controlled trials, quasi-experimental designs, regression discontinuity designs, and single-case designs.

**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 from group design studies supports the findings in an intervention report. The extent of evidence categorization for intervention reports focuses on the number and sizes of studies of the intervention in order to give an indication of how broadly findings may be applied to different settings. There are two extent of evidence categories: small and medium to large.
- **small:** includes only one study, or one school, or findings based on a total sample size of less than 350 students and 14 classrooms (assuming 25 students in a class)
  - **medium to large:** includes more than one study, more than one school, and findings based on a total sample of at least 350 students or 14 classrooms
- Gain scores** The result of subtracting the pretest from the posttest for each individual in the sample. Some studies analyze gain scores instead of the unadjusted outcome measure as a method of accounting for the baseline measure when estimating the effect of an intervention. The WWC reviews and reports findings from analyses of gain scores, but gain scores do not satisfy the WWC’s requirement for a statistical adjustment under the baseline equivalence requirement. This means that a study that must satisfy the baseline equivalence requirement and has baseline differences between 0.05 and 0.25 standard deviations *Does Not Meet WWC Group Design Standards* if the study’s only adjustment for the baseline measure was in the construction of the gain score.
- Group design** A study design in which outcomes for a group receiving an intervention are compared to those for a group not receiving the intervention. Comparison group designs eligible for WWC review are randomized controlled trials and quasi-experimental designs.
- 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** An adjustment to the statistical significance of results to account for multiple comparisons in a group design study. The WWC uses the Benjamini-Hochberg (BH) correction to adjust the statistical significance of results within an outcome domain when study authors perform multiple hypothesis tests without adjusting the  $p$ -value. The BH correction is used in three types of situations: studies that tested multiple outcome measures in the same outcome domain with a single comparison group; studies that tested a given outcome measure with multiple comparison groups; and studies that tested multiple outcome measures in the same outcome domain with multiple comparison groups. Because repeated tests of highly correlated constructs will lead to a greater likelihood of mistakenly concluding that the impact was different from zero, in all three situations, the WWC uses the BH correction to reduce the possibility of making this error. The WWC makes separate adjustments for primary and secondary findings.

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

<b>Outcome domain</b>	A group of closely-related outcomes. A domain is the organizing construct for a set of related outcomes through which studies claim effectiveness.
<b>Quasi-experimental design (QED)</b>	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.
<b>Randomized controlled trial (RCT)</b>	A randomized controlled trial (RCT) is an experiment in which eligible study participants are randomly assigned to intervention and comparison groups.
<b>Rating of effectiveness</b>	For group design research, the WWC rates the effectiveness of an intervention in each domain based on the quality of the research design and the magnitude, statistical significance, and consistency in findings. For single-case design research, the WWC rates the effectiveness of an intervention in each domain based on the quality of the research design and the consistency of demonstrated effects.
<b>Regression discontinuity design (RDD)</b>	A design in which groups are created using a continuous scoring rule. For example, students may be assigned to a summer school program if they score below a preset point on a standardized test, or schools may be awarded a grant based on their score on an application. A regression line or curve is estimated for the intervention group and similarly for the comparison group, and an effect occurs if there is a discontinuity in the two regression lines at the cutoff.
<b>Single-case design</b>	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.
<b>Standard deviation</b>	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.
<b>Statistical significance</b>	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% ( $p < .05$ ).
<b>Study rating</b>	The result of the WWC assessment of a study. The rating is based on the strength of the evidence of the effectiveness of the educational intervention. Studies are given a rating of <i>Meets WWC Design Standards without Reservations</i> , <i>Meets WWC Design Standards with Reservations</i> , or <i>Does Not Meet WWC Design Standards</i> , based on the assessment of the study against the appropriate design standards. The WWC has design standards for group design, single-case design, and regression discontinuity design studies.
<b>Substantively important</b>	A substantively important finding is one that has an effect size of 0.25 or greater, regardless of statistical significance.
<b>Systematic review</b>	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.



Practice Guide



Quick Review



Single Study Review

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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