What Works Clearinghouse

INSTITUTE OF EDUCATION SCIENCES

Elementary School Math September 2010

Accelerated Math™

Program Description[1]

Accelerated Math™, published by Renaissance Learning, is a software tool used to customize assignments and monitor progress in mathematics for students in grades 1–12.[2] *Accelerated Math*™ creates individualized assignments that align with state standards and national guidelines, scores student work, and generates formative feedback through reports for teachers and students. The software can be used in conjunction with the existing math curriculum to add practice components and aid teachers in differentiating instruction via the program's progress-monitoring data.

Research[3]

One study of *Accelerated Math*™ that falls within the scope of the Elementary School Math review protocol meets What Works Clearinghouse (WWC) evidence standards, and two studies meet WWC evidence standards with reservations. The three studies included 2,179 students from grades 2–5 in over 60 schools across multiple states.[4] Studies included in this review assess the effectiveness of the first edition of *Accelerated Math*™.

Based on these three studies, the WWC considers the extent of evidence for *Accelerated Math*™ on elementary school students to be medium to large for math achievement.

Effectiveness

Accelerated Math™ was found to have mixed effects on math achievement for elementary school students.

	Math achievement
Rating of effectiveness	Mixed effects
Improvement index[5]	Average: +7 percentile points Range: +2 to +10 percentile points

1. The descriptive information for this program was obtained from publicly available sources: the program's website (http://www.renlearn.com/am/, downloaded June 2010) and the three studies that met WWC standards either with or without reservations: Nunnery and Ross (2007), Ysseldyke and Bolt (2007), and Ysseldyke and Tardrew (2007). The WWC requests developers to review the program description sections for accuracy from their perspective. Further verification of the accuracy of the descriptive information for this program is beyond the scope of this review. The literature search reflects documents publicly available by August 2008.
2. This review refers to studies of *Accelerated Math*™ in kindergarten through fifth grade. Studies of *Accelerated Math*™ conducted in sixth through twelfth grades were out of the scope of the Elementary School Math protocol.
3. The studies in this report were reviewed using WWC Evidence Standards, Version 1.0 (see the WWC Standards), as described in protocol Version 1.1.
4. The evidence presented in this report is based on available research. Findings and conclusions may change as new research becomes available.
5. These numbers show the average and range of student-level improvement indices for all findings across the studies.

Additional program information

Developer and contact

Renaissance Learning developed and distributes *Accelerated Math*™. Address: PO Box 8036, Wisconsin Rapids, WI 54495-8036. Email: answers@renlearn.com. Web: http://www.renlearn.com/am/. Telephone: (800) 338-4204.

Scope of use

The first edition of *Accelerated Math*™ was released in 1998. In 2008, Renaissance Learning released the *Accelerated Math*™ Second-Edition Libraries, which included a revised scope and sequence for grades 1–8, algebra 1, and geometry. According to the developers, more than 30,000 schools nationwide use *Accelerated Math*™ and other Renaissance Learning math programs.

Teaching

The *Accelerated Math*™ software can be used with existing textbooks and instructional methods for students in grades 1–12 to add practice assignments and progress monitoring to the existing curriculum. Students are placed into grade-level libraries in *Accelerated Math*™ based on either teacher discretion or their performance on a norm-referenced, standardized measure of general math achievement. After instruction on a math objective, teachers can use the software to create individualized practice assignments for students. Students then record their answers through handheld responders or on forms that are scanned into the computer. After scoring the assignment, the software generates a report showing student progress in mastering the objective, as well as information about items answered correctly and incorrectly. Teachers also receive student- and classroom-level reports. After reviewing students' progress, teachers can adjust instruction for the entire class, for small groups of students struggling with similar objectives, or for individual students as needed. *Accelerated Math*™ generates future assignments based on a student's performance on previous assignments.

Cost[6]

Accelerated Math™ can be purchased as a school package or a single classroom package. The *Accelerated Math*™ Enterprise Edition, a school package, is available for a one-time school fee, plus an annual fee per student. The Enterprise license includes nine hours of web-based professional development for teachers, content libraries for grade 1 math through calculus, unlimited technical support, software updates, and hosting of the software for the first year. After the first year, additional web hosting costs are incurred. The cost of an optical scanner (needed to grade student assignments) is not included.

Research

Thirty-two studies reviewed by the WWC investigated the effects of *Accelerated Math*™. One study (Ysseldyke & Bolt, 2007) is a randomized controlled trial that meets WWC evidence standards. Two studies (Nunnery & Ross, 2007; Ysseldyke & Tardrew, 2007) are quasi-experimental designs that meet WWC evidence standards with reservations. The remaining 29 studies do not meet either WWC evidence standards or eligibility screens

Meets evidence standards

Ysseldyke and Bolt (2007) conducted a randomized controlled trial of *Accelerated Math*™ involving schools that had requested a price quote for *Accelerated Math*™ but had not purchased the software. In exchange for participation in the study, schools were offered *Accelerated Math*™ software, support materials, technical support, and professional development by an *Accelerated Math*™ consultant. Each elementary school had to have at least three teachers in a given grade to be eligible. Within each participating elementary school, teachers in each grade were randomly assigned to either the treatment group, the control group, or a third group that began implementing *Accelerated Math*™ halfway through the school year. The latter group is not utilized in this report. The authors assessed the impact of

6. Specific pricing is unavailable on the developer's website. Instead, contact information is listed to be able to obtain a direct quote.

Accelerated Math™ using the STAR Math and Terra Nova exams. The study sample included students in grades 2–8, but only those in grades 2–5 are relevant to this Elementary Math review. The elementary school analysis sample included approximately 700 students (analysis samples varied across outcomes) in 40 classrooms in five schools across four states. Treatment classrooms were assigned to be taught using *Accelerated Math*™ as an integrated addition to the existing math curriculum. The existing curricula included: *Harcourt Math* or *Silver Burdett Math* in Alabama, *Houghton Mifflin Math Central* in Florida and South Carolina, and *Sharon Wells Math* or *Harcourt Math* in Texas. Control classrooms, which were in the same schools as the treatment classrooms, were assigned to be taught using the existing curriculum without *Accelerated Math*™. In practice, the *Accelerated Math*™ program was not implemented for approximately 40% of students in grades 2–8 in the initial treatment sample; the authors did not report the implementation percentage for the elementary school analysis sample.

Meets evidence standards with reservations

Nunnery and Ross (2007) conducted a quasi-experiment to assess the impact of the *School Renaissance* program—a comprehensive school reform model, which includes the *Accelerated Math*™ and *Accelerated Reader* programs—on math achievement in a suburban Texas school district. Although supplemented by a professional development component known as *Math Renaissance*, the program's key math component was *Accelerated Math*™. Nine treatment elementary schools from a single school district were matched to nine comparison elementary schools across multiple districts based on the Texas Education Association's Academic Excellence Indicator System (AEIS). The AEIS groups each school with 40 similar schools based on their percentage of African-American, Hispanic, Caucasian, economically disadvantaged, and limited English proficient students, as well as student mobility rates as determined by cumulative attendance. From the list of 40 similar schools, the most similar school on percent of economically disadvantaged students and base year accountability rating (low performing, acceptable, recognized, or exemplary) was matched to the treatment school, with preference given to those schools that did not implement *Accelerated Math*™ or other components of *School Renaissance*. The treatment schools used *Accelerated Math*™ as their primary math curriculum, but may have supplemented with other materials. The comparison school curriculum is unknown.[7] Although the study sample included students in grades 3–8, only students in grades 3–5 are relevant to this review. The analysis sample included 865 students in 18 elementary schools (416 students in nine treatment schools and 449 in nine comparison schools) who were pretested in the 3rd grade, received *Accelerated Math*™ in the 4th and 5th grades, and have outcomes averaged across the 4th and 5th grades. Math achievement was measured by the Texas Learning Index math scores obtained from the Texas Assessment of Academic Skills.

Ysseldyke and Tardrew (2007) implemented a classroom matched-pairs quasi-experimental design to assess the impact of *Accelerated Math*™ on the STAR Math test. While the study was intended to be a random assignment study, with school principals randomly assigning classrooms to treatment or comparison conditions, the authors reported that in some cases the assignment process had not been random. Thus, the WWC reviewed the study as a quasi-experimental design. The total study sample (grades 3–10) included 2,397 students in 125 classrooms in 27 schools in 24 states. Results are reported for grade 4, which included 614 students (303 treatment and 311 comparison). The WWC did not report results for grades 3 and 5 because the treatment and comparison groups were sufficiently different at baseline to require a statistical control for pretest differences (see the Elementary School Math protocol for more detail). While the authors use a gain score to account for differences in baseline test scores, the WWC requires a covariate-adjusted estimate for statistical control. Teachers assigned to the *Accelerated Math*™ treatment group were asked to use

7. Curriculum information for the treatment and comparison groups was clarified by the study authors.

Research *(continued)*

the program with their existing math curriculum for the spring semester. Comparison group teachers, drawn from the same schools, only used the existing math curriculum.

Extent of evidence

The WWC categorizes the extent of evidence in each domain as small or medium to large (see the WWC Procedures and Standards Handbook, Appendix G). The extent of evidence takes into account the number of studies and the total sample size across the studies that meet WWC evidence standards with or without reservations.[8]

The WWC considers the extent of evidence for *Accelerated Math*™ on elementary school students to be medium to large for math achievement.

Effectiveness

Findings

The WWC review of interventions for Elementary School Math addresses student outcomes in math achievement. The findings below present the authors' estimates and WWC-calculated estimates of the size and statistical significance of the effects of *Accelerated Math*™ on elementary school students.[9]

Ysseldyke and Bolt (2007) examined two math achievement outcomes: the STAR Math and Terra Nova math subtests. The authors reported a statistically significant positive effect for one outcome (STAR Math) and no statistically significant effect for the other (Terra Nova).[10] In WWC calculations, for both outcomes, the effects were neither statistically significant nor large enough to be considered substantively important according to WWC criteria (an effect size greater than 0.25).

Nunnery and Ross (2007) reported a positive and statistically significant effect of *Accelerated Math*™ on overall math achievement based on the Texas Learning Index math scores. In WWC calculations, this finding was neither statistically significant nor substantively important according to WWC criteria.

Ysseldyke and Tardrew (2007) reported a positive and statistically significant effect of *Accelerated Math*™ for grades 3, 4, and 5 on overall math achievement based on STAR Math scale scores. In WWC calculations for grade 4, the findings were not statistically significant, but were large enough to be considered substantively important according to WWC criteria. For grades 3 and 5, the WWC could not confirm the findings because the treatment and comparison groups were not equivalent at baseline, and the results did not employ a statistical control for pretest differences.

In summary, the WWC reviewed findings from three studies that contained math achievement outcomes. One of the studies found substantively important positive effects, while the other two studies showed indeterminate effects.

Rating of effectiveness

The WWC rates the effects of an intervention in a given outcome domain as positive, potentially positive, mixed, no discernible effects, potentially negative, or negative. The rating of effectiveness takes into account four factors: the quality of the research design, the statistical significance of the findings, the size of the difference between participants in the intervention and the comparison conditions, and the consistency in findings across studies (see the WWC Procedures and Standards Handbook, Appendix E).

8. The extent of evidence categorization was developed to tell readers how much evidence was used to determine the intervention rating, focusing on the number and size of studies. Additional factors associated with a related concept—external validity, such as the students' demographics and the types of settings in which studies took place—are not taken into account for the categorization. Information about how the extent of evidence rating was determined for *Accelerated Math*™ is in Appendix A5.
9. The level of statistical significance was reported by the study authors or, when necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For an explanation, see the WWC Tutorial on Mismatch. For the formulas the WWC used to calculate the statistical significance, see WWC Procedures and Standards Handbook, Appendix C for clustering and WWC Procedures and Standards Handbook, Appendix D for multiple comparisons. In the case of Ysseldyke and Bolt (2007), corrections for clustering and multiple comparisons were needed, so the significance levels may differ from those reported in the original study. In the cases of Nunnery and Ross (2007) and Ysseldyke and Tardrew (2007), corrections for clustering were needed, so the significance levels may differ from those reported in the original studies.
10. The study authors provided the WWC with findings relevant for the Elementary School Math review.

The WWC found *Accelerated Math*™ to have mixed effects for math achievement for elementary school students

Improvement index

The WWC computes an improvement index for each individual finding. In addition, within each outcome domain, the WWC computes an average improvement index for each study and an average improvement index across studies (see WWC Procedures and Standards Handbook, Appendix F). The improvement index represents the difference between the percentile rank of the average student in the intervention condition and the percentile rank of the average student in the comparison condition. Unlike the rating of effectiveness, the improvement index is entirely based on the size of the effect, regardless of the statistical significance of the effect, the study design, or the analysis. The improvement index can take on values between –50 and +50, with positive numbers denoting favorable results for the intervention group.

The average improvement index for math achievement is +7 percentile points across the three studies, with a range of +2 to +10 percentile points across findings.

Summary

The WWC reviewed 32 studies on *Accelerated Math*™. One of these studies meets WWC evidence standards; two studies meet WWC evidence standards with reservations; the remaining 29 studies do not meet either WWC evidence standards or eligibility screens. Based on the three studies, the WWC found mixed effects in math achievement for elementary school students. The conclusions presented in this report may change as new research emerges.

References

Meets WWC evidence standards

Ysseldyke, J., & Bolt, D. M. (2007). Effect of technology-enhanced continuous progress monitoring on math achievement. *School Psychology Review, 36*(3), 453–467.

Additional source:

Ysseldyke, J., & Bolt, D. M. (2005). *High implementers of* Accelerated Math *show significant gains over low- or non-implementers.* Madison, WI: Renaissance Learning, Inc.

Meets WWC evidence standards with reservations

Nunnery, J. A., & Ross, S. M. (2007). The effects of the School Renaissance program on student achievement in reading and mathematics. *Research in the Schools, 14*(1), 40–59.

Ysseldyke, J., & Tardrew, S. (2007). Use of a progress monitoring system to enable teachers to differentiate mathematics instruction. *Journal of Applied School Psychology, 24*(1), 1–28.

Additional sources:

Ysseldyke, J. E., & Tardrew, S. P. (2002). *Differentiating math instruction: A large scale study of* Accelerated Math *(Final report).* Madison, WI: Renaissance Learning, Inc.

Ysseldyke, J. E., Tardrew, S. P., Betts, J., Thill, T., & Hannigan, E. (2003). *Use of an instructional management system to enhance math instruction of gifted and talented students.* Madison, WI: Renaissance Learning, Inc.

Studies that fall outside the Elementary School Math review protocol or do not meet WWC evidence standards

Atkins, J. (2005). *The association between the use of* Accelerated Math *and students' math achievement.* Unpublished doctoral dissertation, East Tennessee State University, Johnson City. The study is ineligible for review because it does not use a sample within the age or grade range specified in the protocol.

Burris, C. C., & Welner, K. G. (2005). A special section on the achievement gap—closing the achievement gap by detracking. *Phi Delta Kappan, 86*(8), 594. The study is ineligible for review because it does not examine the effectiveness of an intervention.

Doe, C. (2006). Marvelous math products. *Multimedia & Internet@Schools, 13*(3), 30–33. The study is ineligible for review because it does not examine the effectiveness of an intervention.

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Forbush, D. (2001). *Math Renaissance improves student achievement and attitudes in Idaho school (Renaissance Independent Research Report No. 35).* Retrieved January 5, 2006 from http://research.renlearn.com/research/pdfs/78.pdf. The study does not meet WWC evidence standards because the intervention and comparison groups are not shown to be equivalent at baseline.

Gillette, B. (2006). Firm, schools, students succeed with tech facilitation. *Mississippi Business Journal, 28*(18), 10. The study is ineligible for review because it does not examine the effectiveness of an intervention.

Gillis, M. B. (2005). *Gender-based education: The pilot year of single-gender classes at a public elementary school.* Unpublished doctoral dissertation, Mississippi State University. The study is ineligible for review because it does not examine the effectiveness of an intervention.

Holmes, C. T., Brown, C. L., & Algozzine, B. (2006). Promoting academic success for all students. *Academic Exchange Quarterly, 10*(3), 141–147. The study does not meet WWC evidence standards because the intervention and comparison groups are not shown to be equivalent at baseline.

Johnson-Scott, P. L. (2006). *The impact of* Accelerated Math *on student achievement.* Unpublished doctoral dissertation, Mississippi State University. The study does not meet WWC evidence standards because the estimates of effects did not account for differences in pre-intervention characteristics while using a quasi-experimental design.

Kosciolek, S. A. (2003). Instructional factors related to mathematics achievement: Evaluation of a mathematics intervention. *Dissertation Abstracts International, 63*(10), 3583A. (UMI No. 3107933) The study is ineligible for review because it does not use a comparison group.

Lehmann, R. H., & Seeber, S. (2005). Accelerated Math *in grades 4 through 6: Evaluation of an experimental program in 15 schools in North Rhine-Westphalia.* Berlin: Humboldt University. The study is ineligible for review because it does not take place in the geographic area specified in the protocol.

Additional source:

Lehmann, R. H., & Seeber, S. (2005). Accelerated Math *in grades 4–6: Summary of a quasi-experimental study in North Rhine-Westphalia, Germany.* Madison, WI: Renaissance Learning, Inc.

Metcalf, E. B. (2005). Accelerated Math *implementation and elementary student achievement and attitudes.* Unpublished master's thesis, University of North Carolina, Wilmington. The study is ineligible for review because it does not use a comparison group.

Renaissance Learning, Inc. (1999). Accelerated Math *and Math Renaissance improves math performance (Scientific Research: Quasi-Experimental series).* Retrieved January 5, 2006, from http://research.renlearn.com/research/pdfs/10.pdf. The study does not meet WWC evidence standards because the intervention and comparison groups are not shown to be equivalent at baseline.

Renaissance Learning, Inc. (2004). *First and second grade students demonstrate accelerated growth with Math Renaissance: Union county primary school, Blairsville, Georgia.* Madison, WI: Author. The study is ineligible for review because it does not use a comparison group.

Renaissance Learning, Inc. (2005). *Iowa school boosts Iowa Test of Basic Skills reading and math scores: Richardson Elementary School.* Madison, WI: Author. The study is ineligible for review because it does not use a comparison group.

Renaissance Learning, Inc. (2005). *Washington school dramatically improves reading and math state test scores.* Madison, WI: Author. The study is ineligible for review because it does not use a comparison group.

Renaissance Learning, Inc. (2006). *Iowa elementary school pairs best practices with student motivation and sees significant gains in Iowa Test of Basic Skills scores: Hawthorne Elementary School.* Madison, WI: Author. The study is ineligible for review because it does not use a comparison group.

Renaissance Learning, Inc. (2006). *Reading and math state test scores climb at rural Texas school: Finley-Oates Elementary*

References *(continued)*

School. Madison, WI: Author. The study is ineligible for review because it does not use a comparison group.

Renaissance Learning, Inc. (2007). *Test scores on the rise and library growth skyrocketing at Indiana elementary school.* Madison, WI: Author. The study is ineligible for review because it does not use a comparison group.

Ross, S. M., & Nunnery, J. A. (2005). *The effect of School Renaissance on student achievement in two Mississippi school districts.* Memphis, TN: Center for Research in Educational Policy. The study does not meet WWC evidence standards because the intervention and comparison groups are not shown to be equivalent at baseline.

Additional source:

Ross, S. M., Nunnery, J. A., Avis, A., & Borek, T. (2005). *The effects of School Renaissance on student achievement in two Mississippi school districts: A longitudinal quasi-experimental study.* Memphis, TN: Center for Research in Educational Policy.

Rudd, P., & Wade, P. (2006). *Evaluation of Renaissance Learning mathematics and reading programs in UK Specialist and feeder schools.* Slough, UK: National Foundation for Educational Research. The study is ineligible for review because it does not take place in the geographic area specified in the protocol.

Sadusky, L. A., & Brem, S. K. (2002). *The use of* Accelerated Math *in an urban Title I elementary school.* Tempe, AZ: Arizona State University. The study does not meet WWC evidence standards because the intervention and comparison groups are not shown to be equivalent at baseline.

Scott, A. M. (2005). *A quantitative examination of Title I and non-Title I elementary schools in East Tennessee using fourth-grade math and reading standardized test scores.* Unpublished doctoral dissertation, East Tennessee State University, Johnson City. The study is ineligible for review because it does not examine the effectiveness of an intervention.

Spicuzza, R., Ysseldyke, J., Lemkuil, A., McGill, S., Boys, C., & Teelucksingh, E. (2001). Effects of curriculum-based monitoring on classroom instruction and math achievement. *Journal of School Psychology, 39*(6), 521–542. The study does not meet WWC evidence standards because the intervention and comparison groups are not shown to be equivalent at baseline.

Additional source:

Spicuzza, R., Ysseldyke, J. E., Lemkuil, A., Kosciolek, S., Boys, C., & Teelucksingh, E. (2001). *Effects of using a curriculum-based monitoring system on the classroom instructional environment and math achievement*. Minneapolis, MN: National Center on Educational Outcomes, University of Minnesota.

Stessman, M. (2006). *Closing the economic achievement gap: A case study of a successful Kansas secondary school.* Unpublished master's thesis, Wichita State University, Kansas. The study is ineligible for review because it does not use a sample within the age or grade range specified in the protocol.

West, M. D. (2005). *The effectiveness of using* Accelerated Math *to increase student mathematical achievement and its impact on student and parent attitudes toward mathematics.* Unpublished master's thesis, University of Georgia, Athens. The study is ineligible for review because it does not use a comparison group.

Ysseldyke, J. (2005). Assessment and decision making for students with learning disabilities: What if this is as good as it gets? *Learning Disability Quarterly, 28*(2), 125–128. The study is ineligible for review because it does not examine the effectiveness of an intervention.

Ysseldyke, J., Spicuzza, R., Kosciolek, S., Teelucksingh, E., Boys, C., & Lemkuil, A. (2003). Using a curriculum-based instructional management system to enhance math achievement in urban schools. *Journal of Education for Students Placed at Risk, 8*(2), 247–265. The study is ineligible for review because it does not examine an intervention implemented in a way that falls within the scope of the review.

Ysseldyke, J., Spicuzza, R., Kosciolek, S., & Boys, C. (2003). Effects of a learning information system on mathematics

References *(continued)*

achievement and classroom structure. *Journal of Educational Research, 96*(3), 163–173. The study is ineligible for review because it does not examine an intervention implemented in a way that falls within the scope of the review.

Ysseldyke, J. E., Spicuzza, R., & McGill, S. (2000). *Changes in mathematics achievement and instructional ecology resulting from implementation of a learning information system.* Minneapolis, MN: National Center on Educational Outcomes, University of Minnesota. Retrieved January 5, 2006, from http://www.cehd.umn.edu/NCEO/OnlinePubs/archive/AssessmentSeries/EBASSreport.pdf. The study does not meet WWC evidence standards because the intervention and comparison groups are not shown to be equivalent at baseline.

Appendix

Appendix A1.1 Study characteristics: Ysseldyke & Bolt, 2007

Characteristic	Description
Study citation	Ysseldyke, J., & Bolt, D. M. (2007). Effect of technology-enhanced continuous progress monitoring on math achievement. *School Psychology Review, 36*(3), 453–467.
Participants	The initial study sample included 3,309 students from 133 classrooms in nine schools, representing eight school districts in eight states. Sample students were in grades 2–8 during the 2003–04 school year. In the initial study sample, 38% of the students were Hispanic, 28% were African-American, 24% were Caucasian, 1% were Asian, 0% were Native American, and 8% were not specified. The baseline sample for grades 2–5 was 896 students (441 treatment and 455 control) in 40 classrooms (20 treatment and 20 control). The results here are drawn from the test-takers in the 40 elementary school classrooms included in the analysis—587 students took the STAR Math test (315 treatment, 272 control) and 700 took the Terra Nova test (355 treatment, 345 control). Postattrition treatment and control groups were equivalent on pretests at baseline.
Setting	The elementary school sample analyzed here comprises five schools in four states: Alabama, Florida, South Carolina, and Texas.
Intervention	Students were taught by teachers using the *Accelerated Math*™ program during the 2003–04 school year. Teachers assigned to the treatment group were asked to use *Accelerated Math*™ with their regular math curriculum. The existing curricula included: *Harcourt Math* or *Silver Burdett Math* in Alabama, *Houghton Mifflin Math Central* in Florida and South Carolina, and *Sharon Wells Math* or *Harcourt Math* in Texas. In practice, the program was not implemented for approximately 40% of grade 2–8 students in the initial treatment group; the authors did not report the percentage of grade 2–5 students in the treatment group of the analysis sample that did not participate in *Accelerated Math*™.
Comparison	Students in the control group were taught using the same set of math curricula as the treatment group, but without the addition of *Accelerated Math*™.
Primary outcomes and measurement	Participating students were pretested in October 2003 and posttested in May 2004 using two nationally normed, standardized tests (STAR Math and Terra Nova) for math achievement. Students in the treatment and control groups were compared using a linear regression analysis in which posttest scores were regressed on pretest scores. In the paper, the authors include school level dummies and interactions between the school and the treatment group in their analysis of outcomes for students in grades 2–8. The results presented in this report related to students in grades 2–5 (provided to the WWC by the author) include only controls for pretests. For a more detailed description of these outcome measures, see Appendix A2.
Staff/teacher training	Teachers in the intervention group were trained to use *Accelerated Math*™. During the school year, teachers using *Accelerated Math*™ received three to five visits from a Renaissance Learning math consultant, who guided teachers on how to improve their use of the program. Teachers also had unlimited access to technical support.

Appendix A1.2 Study characteristics: Nunnery & Ross, 2007

Characteristic	Description
Study citation	Nunnery, J., & Ross, S. M. (2007). The effects of the School Renaissance program on student achievement in reading and mathematics. *Research in the Schools, 14*(1), 40–59.
Participants	The analysis sample included 865 students (416 treatment, 449 comparison) from 18 elementary schools (nine treatment and nine comparison). These students were in grade 5 during the 2001–02 school year. Students in the analysis sample remained in the same school and had matched data available for three consecutive years (the 1999–2000 to 2001–02 school years). Characteristics of the student sample varied across the 18 schools. Between 0% and 59% in each school qualified for free or reduced-price lunch. Between 0% and 35% of students in each school were limited English proficient, and the proportion of students who were Caucasian ranged from 25% to 95%.
Setting	The treatment group schools came from one suburban school district in Texas. Comparison schools came from other school districts with similar populations of students in Texas.
Intervention	In the 2000–01 school year, schools in the treatment group began implementing School Renaissance, a comprehensive school reform model that includes *Accelerated Math*™. Students in the treatment group experienced two years of the *Accelerated Math*™ program as their primary mathematics curriculum. Treatment schools may have supplemented with other materials.
Comparison	Schools in the comparison condition were from Texas school districts that had not implemented the full School Renaissance package. It is possible that some elements of School Renaissance (e.g., *Accelerated Math*™) were present in the comparison schools; however, the comparison group curriculum is unknown.
Primary outcomes and measurement	The study used the Texas Learning Index math scores (based on the Texas Assessment of Academic Skills); for the grade 5 cohort, program comparisons were based on average transformed scores for grades 4 and 5 from 2001 and 2002. For a more detailed description of this outcome measure, see Appendix A2.
Staff/teacher training	A Renaissance coach conducted an initial training seminar and provided ongoing assistance to teachers.

Appendix A1.3 Study characteristics: Ysseldyke & Tardrew, 2007

Characteristic	Description
Study citation	Ysseldyke, J., & Tardrew, S. (2007). Use of a progress monitoring system to enable teachers to differentiate mathematics instruction. *Journal of Applied School Psychology, 24*(1), 1–28.
Participants	The initial study sample included 2,397 students (1,319 treatment and 1,078 comparison) in grades 3–10 during the 2001–02 school year. Students were drawn from 125 classrooms (67 treatment and 58 comparison) in 47 schools in 24 states. The elementary school analysis sample in this review included 1,680 students (869 treatment and 811 comparison) in grades 3–5. The grade 3 and grade 5 samples had large differences in baseline test scores that were not controlled for in the analysis. Therefore, only the grade 4 results for 614 students (303 treatment and 311 comparison) are reported.
Setting	The study was conducted in 47 schools in 24 states (Alabama, Arkansas, California, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Massachusetts, Michigan, Minnesota, Missouri, Montana, New Mexico, Ohio, Oklahoma, Oregon, Pennsylvania, Tennessee, Texas, Virginia, Washington, and Wisconsin). The authors did not report whether all schools and states were represented in the elementary school sample.
Intervention	Students were taught by teachers using *Accelerated Math*™ during the spring semester of the 2001–02 school year. Teachers assigned to the *Accelerated Math*™ treatment group were asked to use the program with their existing math curriculum.
Comparison	Comparison classrooms were drawn from the same schools as treatment classrooms. Teachers assigned to the comparison group used their usual math curriculum and practices.
Primary outcomes and measurement	Students were pretested in January 2002 and posttested in May 2002 using STAR Math, a computer adaptive math achievement test. For a more detailed description of this outcome measure, see Appendix A2.
Staff/teacher training	Intervention teachers participated in a one-day training session conducted by Renaissance Learning. The training was designed to familiarize teachers with *Accelerated Math*™ and to guide them in integrating it into curriculum and instruction. Of 68 treatment group teachers in the full sample (grades 3–8), 66 attended the training.

Appendix A2 Outcome measures for the math achievement domain

Outcome measure	Description
Terra Nova mathematics subtest	The Terra Nova subtest is a national norm-referenced test that assesses academic performance in math.
Texas Learning Index math scores (based on the Texas Assessment of Academic Skills)	The Texas Assessment of Academic Skills (TAAS) is a criterion-referenced standardized state test that measures problem-solving and critical-thinking skills. The Texas Learning Index (TLI) is an outcome metric, based on student performance on the TAAS, which allows for comparisons between administrations and between grades. The TLI has a common interpretation across grades: a score of 70 or above indicates the student performed at or above grade-level expectations. A student receiving the same score at consecutive grade levels made one year of academic progress. Analyses in the study were based on a transformation of the TLI that was conducted to give the measure a desirable statistical property (a normal distribution).
STAR Math assessment	STAR Math is a computer-adaptive math test that assesses math skills. It combines computation and numeration items with word problems, estimation, statistics, charts and graphs, geometry, measurement, and algebra. STAR scores can appear as scaled scores or normal curve equivalent values. STAR Math was developed by Renaissance Learning.

Appendix A3 Summary of study findings included in the rating for the math achievement domain[1]

			Authors' findings from the study		WWC calculations			
			Mean outcome (standard deviation)[2]					
Outcome measure	Study sample	Sample size (students)	*Accelerated Math*™ group	Comparison group	Mean difference[3] (*Accelerated Math*™ – comparison)	Effect size[4]	Statistical significance[5] (at $\alpha = 0.05$)	Improvement index[6]
Ysseldyke & Bolt, 2007[7]								
STAR Math normal curve equivalent scores	Grades 2–5	587	47.12[8] (21.40)	44.72[9] (24.05)	2.40	0.11	ns	+4
Terra Nova normal curve equivalent scores	Grades 2–5	700	46.59[8] (18.23)	45.43[9] (19.89)	1.16	0.06	ns	+2
Average for math achievement (Ysseldyke & Bolt, 2007)[10]						**0.08**	**ns**	**+3**
Nunnery & Ross, 2007[7]								
2001 and 2002 transformed Texas Learning Index scores	Grade 5 cohort	865	1.26[11] (0.28)	1.21 (0.30)	0.05	0.17	ns	+7
Average for math achievement (Nunnery & Ross, 2007)[10]						**0.17**	**ns**	**+7**
Ysseldyke & Tardrew, 2007[7]								
STAR Math scale scores	Grade 4	614	686.50[12] (85.74)	665.22[13] (85.46)	21.28	0.25	ns	+10
Average for math achievement (Ysseldyke & Tardrew, 2007)[10]						**0.25**	**ns**	**+10**
Domain average for math achievement across all studies[10]						**0.17**	**na**	**+7**

ns = not statistically significant
na = not applicable

1. This appendix reports findings considered for the effectiveness rating and the average improvement indices for the math achievement domain.
2. The standard deviation across all students in each group shows how dispersed the participants' outcomes are: a smaller standard deviation on a given measure would indicate that participants had more similar outcomes.
3. Positive differences and effect sizes favor the intervention group; negative differences and effect sizes favor the comparison group.
4. For an explanation of the effect size calculation, see WWC Procedures and Standards Handbook, Appendix B.
5. Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups.
6. The improvement index represents the difference between the percentile rank of the average student in the intervention condition and that of the average student in the comparison condition. The improvement index can take on values between –50 and +50, with positive numbers denoting favorable results for the intervention group.
7. The level of statistical significance was reported by the study authors or, when necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For an explanation, see the WWC Tutorial on Mismatch. For the formulas the WWC used to calculate the statistical significance, see WWC Procedures and Standards Handbook, Appendix C for clustering and WWC Procedures and Standards Handbook, Appendix D for multiple comparisons. In the case of Ysseldyke and Bolt (2007), corrections for clustering and multiple comparisons were needed, so the significance levels may differ from those reported in the original study. In the cases of Nunnery and Ross (2007) and Ysseldyke and Tardrew (2007), corrections for clustering were needed, so the significance levels may differ from those reported in the original studies.

(continued)

8. The intervention group means from Ysseldyke and Bolt (2007) differ from those presented in the paper. The WWC calculated the intervention group means by adding the impact of the program, derived from a regression that include a control for pretest differences, to the unadjusted comparison group means. The study authors provided the WWC with the impact, unadjusted comparison group mean, and standard deviations for both groups only for elementary schools.
9. The comparison group mean from Ysseldyke and Bolt (2007) is unadjusted.
10. The WWC-computed average effect sizes for each study and for the domain across studies are simple averages rounded to two decimal places. The average improvement indices are calculated from the average effect sizes.
11. Nunnery and Ross (2007, pp. 45–46) computed a transformation of the Texas Learning Index score to give the measure a normal distribution and allow for an analysis of covariance.
12. The intervention group mean from Ysseldyke and Tardrew (2007) equals the unadjusted comparison group mean plus the difference in gains between the treatment and comparison groups from pretest to posttest.
13. The comparison group mean from Ysseldyke and Tardrew (2007) is unadjusted.

Appendix A4 *Accelerated Math*™ rating for the math achievement domain

The WWC rates an intervention's effects for a given outcome domain as positive, potentially positive, mixed, no discernible effects, potentially negative, or negative.[1]

For the outcome domain of math achievement, the WWC rated *Accelerated Math*™ as having mixed effects for elementary school students. The remaining ratings (no discernible effects, potentially negative effects, negative effects) were not considered, as *Accelerated Math*™ was assigned the highest applicable rating.

Rating received

Mixed effects: Evidence of inconsistent effects as demonstrated through either of the following criteria.

- Criterion 1: At least one study showing a statistically significant or substantively important *positive* effect, and at least one study showing a statistically significant or substantively important *negative* effect, but no more such studies than the number showing a statistically significant or substantively important *positive* effect.

  Not met. One study showed substantively important positive effects. No studies showed statistically significant or substantively important negative effects.

OR

- Criterion 2: At least one study showing a statistically significant or substantively important effect, and more studies showing an *indeterminate* effect than showing a statistically significant or substantively important effect.

  Met. One study showed substantively important positive effects, and two studies showed indeterminate effects.

Other ratings considered

Positive effects: Strong evidence of a positive effect with no overriding contrary evidence.

- Criterion 1: Two or more studies showing statistically significant *positive* effects, at least one of which met WWC evidence standards for a *strong* design.

  Not met. No studies showed statistically significant positive effects.

AND

- Criterion 2: No studies showing statistically significant or substantively important *negative* effects.

  Met. No studies showed statistically significant or substantively important negative effects.

Potentially positive effects: Evidence of a positive effect with no overriding contrary evidence.

- Criterion 1: At least one study showing a statistically significant or substantively important *positive* effect.

  Met. One study showed substantively important positive effects.

AND

- Criterion 2: No studies showing a statistically significant or substantively important *negative* effect, and fewer or the same number of studies showing *indeterminate* effects than showing statistically significant or substantively important *positive* effects.

  Not met. No studies showed negative effects, but more studies showed indeterminate effects than positive effects.

1. For rating purposes, the WWC considers the statistical significance of individual outcomes and the domain-level effect. The WWC also considers the size of the domain-level effect for ratings of potentially positive or potentially negative effects. For a complete description, see the WWC Procedures and Standards Handbook, Appendix E.

Appendix A5 Extent of evidence by domain

		Sample size		
Outcome domain	Number of studies	Schools	Students	Extent of evidence[1]
Math achievement	3	61[2]	2,179[3]	Medium to large

1. A rating of "medium to large" requires at least two studies and two schools across studies in one domain and a total sample size across studies of at least 350 students or 14 classrooms. Otherwise, the rating is "small." For more details on the extent of evidence categorization, see the WWC Procedures and Standards Handbook, Appendix G.
2. For Ysseldyke and Tardrew (2007), the WWC was unable to determine the exact number of schools that were included in the analysis sample for the grades presented in this report.
3. For Ysseldyke and Bolt (2007), this presumes that the students who took the STAR Math test are a subset of those who took the Terra Nova. Otherwise, the number of students could be larger than 2,179.