Appendix

Appendix A1 Extent of evidence

Intervention name	Number of studies	Sample size (schools/students)	Extent of evidence[1]
Everyday Mathematics®	4	171/12,306	Medium to large
Houghton Mifflin Math	2	Over 800/nr	Medium to large
Progress in Mathematics © 2006	1	4/186	Small
Saxon Elementary School Math	1	299/nr	Small
Scott Foresman-Addison Wesley Mathematics	1	6/645	Small

nr = not reported

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."

Appendix A2 Targeted population

Program name	Targeted students (grades)	Students in studies reviewed (grades)[1]
Everyday Mathematics®	K–6	3–5
Houghton Mifflin Math	K–6	2–5
Progress in Mathematics © 2006	K–6	1
Saxon Elementary School Math	K–5	1–5
Scott Foresman-Addison Wesley Mathematics	K–6	2, 4

Note: This table compares targeted grade levels and the grade levels in the studies reviewed by the WWC. Grade levels are related to student age and may affect outcomes due to differences in the students' developmental stages as well as differences in school size and organization.

1. This table shows only the grade levels of students included in the WWC review. Some of the studies reviewed included students in grades 6 or above; however, findings for those students were not reviewed because those higher grade levels were considered to be outside the scope of this review.

Appendix A3 Summary of statistically significant[1] or substantively important[2] positive outcomes

	Math achievement[3]	
	Statistically significant positive findings	Math achievement across outcomes
Everyday Mathematics®		
Carroll, 1998 (quasi-experimental design)	ns	ns, Substantively important
Riordan & Noyce, 2001—early implementers (quasi-experimental design)	Massachusetts Comprehensive Assessment System Mathematics Test	Statistically significant, na[4]
Riordan & Noyce, 2001—late implementers (quasi-experimental design)	ns	ns, na[4]
Waite, 2001 (quasi-experimental design)	ns	Substantively important
Woodward & Baxter, 1997 (quasi-experimental design)	ns	ns, nsi
Houghton Mifflin Math		
EDSTAR, Inc., 2004 (quasi-experimental design)	ns	ns, na[4]
Johnson & Hall, 2003 (quasi-experimental design)	ns	ns, na[4]
Progress in Mathematics © 2006		
Beck Evaluation & Testing Associates, Inc., 2005 (randomized controlled trial)	ns	ns, nsi
Saxon Elementary School Math		
Resendez & Manley, 2005 (quasi-experimental design)	ns	ns, na[4]
Scott Foresman-Addison Wesley Mathematics		
Resendez & Manley, 2005 (randomized controlled trial)	ns	ns, nsi

na = not applicable
ns = not statistically significant
nsi = not substantively important

1. According to the WWC criteria, if a program finds a statistically significant effect, there is less than a 5% chance that this difference is due to chance. The level of statistical significance was calculated by the WWC and, where necessary, corrects for clustering within classrooms or schools and for multiple comparisons. For an explanation about the clustering correction, see the WWC Tutorial on Mismatch. See the Technical Details of WWC-Conducted Computations for the formulas the WWC used to calculate the statistical significance.
2. For rating purposes, the WWC considers the statistical significance of the findings and the magnitude of the effect, also called the effect size. An average effect size is the sum of all the effect sizes of the student outcomes in a study in a single domain divided by the number of those outcomes. The WWC considers an average effect size across all student outcomes in one study in a given domain to be substantively important if it is equal to or greater than 0.25.
3. No studies showed statistically significant or substantively important negative findings. For a detailed description of the outcome measures, see Appendix A2 in the WWC intervention reports at www.whatworks.ed.gov.
4. Student-level effect size could not be computed for this study; whether or not the magnitude of the effect is substantively important is unknown. However, the statistical significance for this study is comparable to other studies and is included in the intervention rating. For further details, please see Technical Details of WWC-Conducted Computations.

Appendix A4 Methodology

The Elementary School Math team reviewed a total of 340 studies. Of those, 237 studies provided data on 73 elementary school math curricula and were classified according to the strength of their design.[1] The remaining 103 studies were classified, but could not be categorized by intervention. To be fully reviewed, a study had to be a randomized controlled trial or quasi-experimental design with evidence of equating between treatment and comparison groups.

Evidence screens

Quasi experiments eligible for review include those equating through matching or statistical adjustment, regression discontinuity, and single case designs. One single case study was identified for the elementary school mathematics review but is not included in this review since we are currently developing evidence standards for regression discontinuity designs and single-case designs.

The review considered the properties of measurement instruments, the percentage of the original study sample that was not included in the reported results and any sample characteristics or events that might serve as alternative explanations for the observed effect. For details please see the WWC Evidence Standards. Both immediate outcomes as well as long-term outcomes of a math intervention were included in our review.

The research evidence for programs that have at least one study meeting WWC evidence standards with or without reservations is summarized in individual intervention reports posted on the WWC website. See http://www.whatworks.ed.gov. So far, 9 studies of 5 elementary school math programs have met evidence standards with or without reservations. The lack of evidence for the remaining programs does not mean that those programs are ineffective; some programs have not yet been studied using a study design that permits the WWC to draw any conclusions about their effectiveness. And for some studies, insufficient data were reported to enable us to confirm statistical findings.

Rating of effectiveness

Each elementary school math curriculum that had at least one study meeting WWC standards with or without reservations received a rating of effectiveness for math achievement. The rating of effectiveness aims to characterize the existing evidence base in a given domain. The intervention effects based on the research evidence can be rated 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 the studies (see the WWC Intervention Rating Scheme).

The level of statistical significance was reported by the study authors or, where necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. Because of these corrections, the level of statistical significance as calculated by the WWC may differ from the one originally reported by the study authors. For an explanation, see the WWC Tutorial on Mismatch. For the formulas that we used to calculate statistical significance, see Technical Details of WWC-Conducted Computations. If the average effect size across all outcome measures in one study in a single domain is at least 0.25, it is considered substantively important, contributing toward the rating of effectiveness. See the technical appendices of the elementary school mathematics intervention reports for further details.

1. One additional program, *Heath Mathematics,* is not included in this count because it was recently discontinued.

Extent of evidence

The evidence base rating represents the size and number of independent samples that were assessed for the purposes of analysis of the program effects. A "medium to large" evidence base requires at least two studies and two schools across studies of at least 350 students or 14 classrooms. Otherwise, the evidence base is considered to be "small." The WWC is currently working to define a "large" evidence base. This term should not be confused with external validity, as other facets of external validity—such as variations in settings, important subgroups of students, implementation, and outcome measures—were not taken into account for the purposes of this rating.

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 outcome domain and study as well as a domain average improvement index across studies of the same intervention (see the Technical Details of WWC-Conducted Computations). 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. The improvement index can take on values between –50 and +50, with positive numbers denoting results favorable to the intervention group. Unlike the rating of effectiveness, the improvement index is based only on the size of the difference between the intervention and the comparison conditions.

Appendix A5 References

Studies that met WWC standards

Progress in Mathematics

Beck Evaluation & Testing Associates, Inc. (2005). *Progress in Mathematics ©2006: Grade 1 pre-post field test evaluation study*. New York: Sadlier-Oxford Division, William H. Sadlier, Inc.

Scott Foresman-Addison Wesley Elementary Mathematics

Resendez, M., & Manley, M. A. (2005). *Final report: A study on the effectiveness of the 2004 Scott Foresman-Addison Wesley Elementary Math program*. Jackson, WY: PRES Associates, Inc.

Additional citation for this study:

Resendez, M., & Sridharan, S. (2005). *Technical report: A study on the effectiveness of the 2004 Scott Foresman–Addison Wesley Elementary Math program.* Jackson, WY: PRES Associates, Inc.

Studies that met WWC standards with reservations

Everyday Mathematics

Carroll, W. M. (1998). Geometric knowledge of middle school students in a reform-based mathematics curriculum. *School Science and Mathematics*, *98*(4), 188–197.

Additional citation for this study:

Carroll, W. M., & Isaacs, A. (2003). Achievement of students using the University of Chicago School Mathematics Project's Everyday Mathematics. In S. L. Senk & D. R. Thompson (Eds.), *Standards-based school mathematics curriculum: Where are they? What do students learn?* (pp. 79–108). Mahwah, NJ: Lawrence Erlbaum Associates, Inc. **(Study: Geometric knowledge of fifth- and sixth-grade students.)**

Riordan, J. E., & Noyce, P. E. (2001). The impact of two standards-based mathematics curricula on student achievement in Massachusetts. *Journal for Research in Mathematics Education*, *32*(4), 368–398.

Waite, R. D. (2000). A study of the effects of Everyday Mathematics on student achievement of third-, fourth-, and fifth-grade students in a large north Texas urban school district. *Dissertation Abstracts International*, *61*(10), 3933A. (UMI No. 9992659)

Woodward, J., & Baxter, J. (1997). The effects of an innovative approach to mathematics on academically low-achieving students in inclusive settings. *Exceptional Children*, *63*(3), 373–388.[1]

Houghton Mifflin Mathematics

EDSTAR, Inc. (2004). *Large-scale evaluation of student achievement in districts using Houghton Mifflin.* Raleigh-Durham, NC: Author.

Additional citation for this study:

EDSTAR, Inc. (2004). *Large-scale evaluation of student achievement in districts using Houghton Mifflin Mathematics: Phase two.* Raleigh-Durham, NC: Author.

Johnson, J., & Hall, M. (2003). *Technical report: Houghton Mifflin California math performance evaluation.* Raleigh, NC: EDSTAR, Inc.

Additional citation for this study:

Johnson, J., Yanyo, L., & Hall, M. (2002). *Evaluation of student math performance in California school districts using Houghton Mifflin Mathematics.* Raleigh, NC: EDSTAR, Inc.

Saxon Elementary School Math

Resendez, M., & Manley, M. A. (2005). *The relationship between using Saxon Elementary and Middle School Math and student performance on Georgia statewide assessments.* Orlando, FL: Harcourt Achieve.

Studies that did not meet evidence screens

Accelerated Math

Forbush, D. (2001). *Math Renaissance improves student achievement and attitudes in Idaho school* (Renaissance Independent

1. Woodward & Baxter (1997) compared the *Heath Mathematics* curriculum to the *Everyday Mathematics* curriculum, and was included in the *Everyday Mathematics* intervention report. The WWC did not produce a *Heath Mathematics* intervention report because the curriculum is no longer distributed.

Research Report No. 35). Retrieved January 5, 2006, from http://research.renlearn.com/research/pdfs/78.pdf[2]

Kosciolek, S. A. (2003). Instructional factors related to mathematics achievement: Evaluation of a mathematics intervention. *Dissertation Abstracts International*, *63*(10), 3583A. (UMI No. 3107933)[3]

Renaissance Learning, Inc. (1999). *Accelerated Math and Math Renaissance improve math performance* (Scientific Research: Quasi-Experimental series). Retrieved January 5, 2006, from http://research.renlearn.com/research/pdfs/10.pdf[4]

Sadusky, L. A., & Brem, S. K. (2002). *The use of Accelerated Math in an urban Title I elementary school.* Tempe: Arizona State University.[2]

Ysseldyke, J., Spicuzza, R., Kosciolek, S., & Boys, C. (2003). Effects of a learning information system on mathematics achievement and classroom structure. *Journal of Educational Research*, *96*(3), 163–173.[5]

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.[5]

Ysseldyke, J. E., Spicuzza, R., & McGill, S. (2000). *Changes in mathematics achievement and instructional ecology resulting from implementation of a learning information system.* Retrieved January 5, 2006, from University of Minnesota, National Center on Educational Outcomes Web site: http://www.education.umn.edu/NCEO/OnlinePubs/EBASSreport.pdf[4]

Ysseldyke, J. E., & Tardrew, S. P. (2002). *Differentiating math instruction: A large scale study of Accelerated Math (Final report).* Madison, WI: Renaissance Learning, Inc.[5]

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.[5]

Adventures of Jasper Woodbury Series

Hickey, D., Moore, A., & Pellegrino, J. (2001). The motivational and academic consequences of elementary mathematics environments: Do constructivist innovations and reforms make a difference? *American Educational Research Journal*, *38*(3), 611–652.[2]

Sherwood, R. D. (1991). *The development and preliminary evaluation of anchored instruction environments for developing mathematical and scientific thinking.* Paper presented at the meeting of the National Association for Research in Science Teaching, Lake Geneva, WI. (ERIC Document Reproduction Service No. ED335221)[4]

Als speciale kleuter tel je ook me! (Young Children with Special Needs Count, Too!)

Van Luit, J. E. H., & Schopman, E. A. M. (2000). Improving early numeracy of young children with special educational needs. *Remedial & Special Education*, *21*(1), 27–40.[6]

Appalachia Model Mathematics Program

Miller, R., Mills, C., & Tangherlini, A. (1995). The Appalachia Model Mathematics Program for gifted students. *Roeper Review*, *18*(2), 138–142.[3]

Barrett Math Program

Ruffin, M. R., Taylor, M., & Butts, L. W. (1991). *Report of the 1989–1990 Barrett Math Program* (Report No. 12, Vol. 25). Atlanta, GA:

2. Lacks evidence for baseline equivalence: this study, which used a quasi-experimental design, did not establish that the comparison group was equivalent to the intervention group at baseline in a pretest measure of math achievement.
3. Does not use a strong causal design: the study did not use a comparison group.
4. Lacks evidence for baseline equivalence: the study, which used a quasi-experimental design, did not establish that the comparison group was equivalent to the treatment group at the baseline.
5. Intervention is not relevant: intervention does not meet the WWC standards of an elementary school math curriculum.
6. The sample is not appropriate to this review: this study did not focus on students in U.S. schools, one of the parameters for this WWC review.

Atlanta Public Schools, Department of Research and Evaluation. (ERIC Document Reproduction Service No. 365508)[4]

Bridges in Mathematics

The Math Learning Center. (2003). *Bridges in the classroom: Teacher feedback, student data, & current research*. Salem, OR: Author.[3]

CAI

Battista, M., & Clements, D. H. (1986). The effects of LOGO and CAI problem-solving environments on problem-solving abilities and mathematics achievement. *Computers and Human Behavior*, *2*(3), 183–193.[5]

Dobbins, E. R. (1993). Math computer assisted instruction with remedial students and students with mild learning/behavior disabilities. *Dissertation Abstracts International*, *54*(08), 2980A. (UMI No. 9403308)[3]

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CompassLearning, Inc. (2002). *School effectiveness report: Gabe P. Allen Charter School, Dallas, Texas.* Retrieved August 12, 2003, from http://www.compasslearning.com/SERs/Dallas_TX.html[3]

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CompassLearning, Inc. (2002). *School effectiveness report: Wilson Elementary School District, Phoenix, Arizona.* Retrieved August 12, 2003, from http://www.compasslearning.com/SERs/Wilson_AZ.html[3]

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Interactive, Inc. (2003, August). *An analysis of CompassLearning student achievement outcomes in Pocatello, Idaho, 2002–03.* (Available from CompassLearning, 9920 Pacific Heights Blvd., San Diego, CA 92121)[3]

Computer Curriculum Corporation (CCC)

Genett, S. J. (1997). The relationship between third-grade students' math achievement in a traditional setting and a computer-assisted instructional setting. *Dissertation Abstracts International*, *59*(08), 2860A. (UMI No. 9903611)[5]

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Computer Managed Mastery Learning

Borton, W. M. (1988). The effects of Computer Managed Mastery Learning on mathematics test scores in the elementary school. *Journal of Computer-Based Instruction*, *15*(3), 95–98.[5]

Connecting Math Concepts (CMC) mathematics program

Brent, G., & Diobilda, N. (1993). Effects of curriculum alignment versus direct instruction on urban children. *Journal of Educational Research*, *86*(6), 333–338.[2]

Jitendra, A. K., & Kameenui, E. J. (1994). An exploratory evaluation of dynamic assessment and the role of basals on comprehension of mathematical operations. *Education & Treatment of Children*, *17*(2), 139–152.[7]

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7. The outcome measures are not relevant to this review: this study does not look at mathematics achievement outcomes.

levels. *Dissertation Abstracts International*, *58*(06), 2160A. (UMI No. 9726165)[8]

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Freiberg, H. J., Connell, M. L., & Lorentz, J. (2001). Effects of consistency management on student mathematics achievement in seven Chapter I elementary schools. *Journal of Education for Students Placed at Risk*, *6*(3), 249–270.[5]

Core Knowledge Curriculum

McHugh, B., & Stringfield, S. (1999). *Core Knowledge Curriculum: Three-year analysis of implementation and effects in five schools* (Report No. 40). Washington, DC: Center for Research on the Education of Students Placed At Risk. (ERIC Document Reproduction Service No. 435766)[2]

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Petropoulos, W. Z. (1999). Improving math achievement scores on the Illinois goals assessment program using the Countdown video tape series. *Dissertation Abstracts International*, *60*(05), 1491A. (UMI No. 9930583)[2]

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Castelda, S., & Wagner, M. (1990). *The Des Moines plan: A plan for student success*. Des Moines, IA: Des Moines Public Schools. (ERIC Document Reproduction Service No. ED322183)[3]

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8. Does not use a strong causal design: there was only one intervention and/or one comparison unit, so the analysis could not separate the effects of the intervention from other factors.
9. Does not use a strong causal design: this is a qualitative study.

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Carroll, W. M. (1996c). Use of invented algorithms by second graders in a reform mathematics curriculum. *Journal of Mathematical Behavior*, *15*(2), 137–150.[9]

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10. Intervention is not relevant: this study evaluated a field test version of the curriculum, not the final version.

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Carroll, W. M., & Isaacs, A. (2003c). Achievement of students using the University of Chicago School Mathematics Project's Everyday Mathematics. In S. L. Senk & D. R. Thompson (Eds.), *Standards-based school mathematics curriculum: Where are they? What do students learn?* (pp. 79–108). Mahwah, NJ: Lawrence Erlbaum Associates, Inc. **(Study: School district studies: HVRSD.)**[4]

Carroll, W. M., & Porter, D. (1994). *A field test of Fourth Grade Everyday Mathematics: Summary report.* Chicago: University of Chicago School Mathematics Project, Elementary Component.[4]

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Everyday Learning Corporation. (1996a). *Everyday Mathematics student achievement studies.* Chicago: Author. **(Study: Greensburg Salem and Everyday Mathematics.)**[4]

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