Everyday Mathematics®

SCIENTIFIC RESEARCH & EVIDENCE OF EFFECTIVENESS

A Comprehensive Summary

The research evidence about *Everyday Mathematics*® almost all points in the same direction: Children who use *Everyday Mathematics* tend to learn more mathematics and like it better than children who use other programs. This finding has been supported by research carried out by the University of Chicago School Mathematics Project (UCSMP), by independent researchers at other universities, and by hundreds of school districts. The absolute amount of this research is large. When compared to what is available for other curricula, it is enormous. As a recent report from the National Academy of Sciences (NRC, 2004) makes clear, no other currently available elementary school mathematics program has been subjected to so much scrutiny by so many researchers. The agreement about the curriculum across so many research studies is, itself, perhaps the strongest evidence that *Everyday Mathematics* is effective.

THE WHAT WORKS CLEARINGHOUSE review of elementary school mathematics curriculum-based programs addresses student outcomes in mathematics achievement. In this review, *Everyday Mathematics* was the only program found to have potentially positive effects on students' mathematics achievement.

NATIONAL RESEARCH COUNCIL "There were 67 coded studies of the National Science Foundation (NSF) curricula, 11 studies of UCSMP curricula, and 17 studies of curricula developed by commercial publishers. As these results suggest, we know more about the evaluations of the UCSMP and other NSF-supported curricula than about the evaluations of the commercial programs."

On Evaluating Curricular Effectiveness, Judging the Quality of K-12 Mathematics Evaluations
National Research Council of the National Academies

Expect More. Achieve More.

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Overview

Research on Learning and Instruction

Everyday Mathematics was developed by the University of Chicago School Mathematics Project (UCSMP) in order to enable children in elementary grades to learn more mathematical content and become life-long mathematical thinkers. Development of *Everyday Mathematics* began with a research phase in 1983. During this phase, the authors of the curriculum reviewed a rich body of existing research on children's mathematical thinking and on curriculum and instruction. They also interviewed hundreds of K-3 children and surveyed instructional practices in other countries. Based on their findings, the authors established several basic principles that have guided the development of *Everyday Mathematics*. These principles are:

- Students acquire knowledge and skills, and develop an understanding of mathematics from their own experiences. Mathematics is more meaningful when it is rooted in real-life contexts and situations, and when children are given the opportunity to become actively involved in learning.
- Children begin school with more mathematical knowledge and intuition than previously believed. A K-6 curriculum should build on this intuitive and concrete foundation, gradually helping children gain an understanding of the abstract and symbolic.
- Teachers, and their ability to provide excellent instruction, are the key factors in the success of any program. Previous efforts to reform mathematics instruction failed because they did not adequately consider the working lives of teachers.

The authors of the curriculum reviewed a rich body of existing research on children's mathematical thinking and on curriculum and instruction. They also interviewed hundreds of K-3 children and surveyed instructional practices in other countries.

Extensive Field Testing Prior to Publication

Starting with kindergarten, *Everyday Mathematics* was developed one grade level at a time. Each grade level went through a three-year development cycle that included one year of writing, a year of extensive field testing, and a year of revising before final publication. *More information on field testing can be found on pages 8–9.*

All three editions of *Everyday Mathematics* have been written by the same core team of authors, in collaboration with a team of mathematicians, education specialists and classroom teachers. This unique development process has resulted in a comprehensive Pre-K–6 curriculum that provides consistent high quality, and a sequence of instruction that carefully builds upon and extends knowledge and skills from year to year.

UCSMP is an ongoing research project in continuing partnership with *Everyday Mathematics* users. Over the years, the *Everyday Mathematics* author team has listened to feedback from classroom teachers who are implementing the program. Based on the continuing dialogue with these users and reviews from other educators, refinements, changes and additions have been made to the program in order to support implementation and to facilitate teachers' professional decision making.

Everyday Mathematics Combines Research, Field Testing and Evaluation

The Research Basis for *Everyday Mathematics*

Everyday Mathematics is based on an extensive body of mathematics education research. This includes the authors own research into children's mathematical thinking, as well as systematic studies of the mathematics education research literature for curriculum content and effective classroom practices.

A research-based program should furnish instruction that reflects current and validated pedagogical elements, identified though studies and evaluations of instructional methods. The authors continue to update the program as new studies and research on instructional methods become available.

Field Testing Studies for *Everyday Mathematics*

Everyday Mathematics was originally created in a process of systematic field testing and revision that lasted from 1986 to 1996. Each grade level (K-6) was written and then field tested in its entirety in diverse classrooms nationwide for a full academic year. During each field test, UCSMP authors interviewed teachers and students about *Everyday Mathematics* to determine what worked and what needed improvement. Finally, the UCSMP authors re-wrote each grade level curriculum to reflect research and experiences prior to publication. These original field tests would also guide future revisions of the materials.

The subsequent editions of *Everyday Mathematics* build on the tradition of research, teacher feedback, and student success. UCSMP continued field testing and revising the curriculum throughout the Second and Third Editions. Field testing for the new Pre-K program, introduced in the Third Edition, began in 2002, and was as intensive as the original rounds of field testing.

Learner Verification and Evaluation Studies for *Everyday Mathematics*

Numerous learner verification studies and evidence of effectiveness studies have been carried out by researchers at UCSMP, by independent researchers, and by schools and districts using the program. A five-year longitudinal study of the *Everyday Mathematics* curriculum was designed and conducted by researchers at Northwestern University.

In 2003, the National Science Foundation (NSF) sponsored the Tri-State Student Achievement Study that evaluated the effectiveness of *Everyday Mathematics*. The study compared the performance of nearly 40,000 students who used the program with an equal number of students from non-using comparison schools carefully matched by reading level, socioeconomic status, and other variables. *More information on this study can be found on pages 12–13.*

Everyday Mathematics is based on research and has been validated by research. Across this research, a wide range of instruments and methodologies have been employed to measure students' progress and understanding, providing a broad perspective on which to evaluate the effects of the curriculum. Many of these studies have appeared in the peer-reviewed mathematics education literature, which means that these studies have been found to meet the criteria of even the most prestigious journals in the field.

Research Foundations of the *Everyday Mathematics* Curriculum – A Selected Annotated Bibliography

Everyday Mathematics is based on an extensive body of mathematics education research into children's mathematical thinking, and on curriculum and instruction. In addition, the authors have drawn upon their own research, and upon studies of instructional practices in other countries such as Russia and Japan, to guide the development of *Everyday Mathematics*.

Bell, M.S. (1974). What does "Everyman" really need from school mathematics? *Mathematics Teacher*, 67, 196-202.

Discusses thirteen topics the author believes to be the minimum objectives of a person's mathematics experience. Argues for increased use of mathematics in everyday life and a focus on broad understanding and higher-learning skills as opposed to behavioral objectives. Asserts that necessary components of mathematics education are: (1) the uses of numbers, algorithms, estimates, variables and computers; (2) the concepts of relations, measures, functions, probability, logic and geometry; (3) the interpretation of graphs; and (4) the links between mathematics and life.

Isaacs, A. C., Carroll, W. M., & Bell, M. (1998). A research-based curriculum: The research foundations of the UCSMP *Everyday Mathematics* curriculum. Chicago, IL: UCSMP.

During the 1980's, a consensus emerged among mathematics educators about how best to teach mathematics to children in school. The NCTM Standards expressed that consensus and communicated it to a broader audience. *Everyday Mathematics* is based largely on the same body of research that led to the standards consensus. This paper describes the research findings that were most influential in the original development of *Everyday Mathematics*.

Bell, M. S. (1972). *Mathematical uses and models in our everyday world.* Studies in mathematics, volume XX. Stanford: School Mathematics Study Group, 1972. (ERIC ED 143-557)

Presents a comprehensive collection of mathematical problems that highlight the applications of mathematics in real-life situations including the physical world, the social structure and industry that are useful to students by the time they reach the middle school years. Organized around basic mathematical ideas that are essential for everyman yet neglected in most schools' materials which offer few genuine applications. Provides a sourcebook for teachers to develop honest applied mathematics for earlier levels of education.

Usiskin, Z. and Bell, M. S. (1983). *Applying Arithmetic: A Handbook of Applications of Arithmetic.* The University of Chicago, 1983. ERIC SE 046 244, SE 046 245, SE 046 246.

Recognizes that the calculator will change the emphasis in mathematics education from how to work answers to when to apply particular arithmetic processes. Addresses the need to incorporate realistic applications of arithmetic in the classroom. Attempts to provide a rather complete categorization of the simpler applications of arithmetic using a large number of examples, as well as ideas to facilitate classroom use.

Other research informing *Everyday Mathematics* curriculum design:

Arron, D. (1993). Classroom implementation and impact of *Everyday Mathematics* K-3: Teachers' perspectives on adopting a reform mathematics curriculum. Chicago, IL: University of Chicago.

Balfanz, R., & Carroll, W. (1997, January). Reforming the elementary mathematics curriculum in the United States. A paper presented at the Tenth International Congress for School Effectiveness and Improvement, Nashville, TN.

Balfanz, R. (1990). Elementary school quality, the mathematics curriculum and the role of local knowledge. *International Review of Education 36*(1): 43-56.

Bell, M. S. (1976). Calculators in elementary schools: Some tentative guidelines and questions based on classroom experience. *Arithmetic Teacher 23*: 502-509.

Bell, M. S. & Bell, J. B. (1988). Assessing and enhancing the counting and numeration capabilities and basic operation concepts of primary school children. Chicago, IL: University of Chicago.

Carroll, W. M. (1995). Increasing mathematics confidence by using worked examples. *The Mathematics Teacher, 88* (4): 276-279.

Carroll, W. M. (1993). The Van Hiele model of geometry: Research and implications for classroom instruction. *The Illinois Mathematics Teacher 44* (2).

Isaacs, A. & Carroll, W. M. (1999). Strategies for basic facts instruction. *Teaching Children Mathematics*, 5 (9), pp. 508-515.

Pattison, W. D. (1997). Bridging curriculum boundaries, grades 1-3. University of Chicago: Chicago, IL.

Reys, B. & Reys, R. (2006, January). The Development and Publication of Elementary Mathematics Textbooks: Let the Buyer Beware! *Phi Delta Kappan 87* (5), pp 377-383.

UCSMP TEXTBOOK TRANSLATIONS SERIES

Among its first projects, the University of Chicago School Mathematics Project (UCSMP) began examining the curricula of other countries for proven ideas and methods. A series of foreign mathematics texts were translated by the Resource Development Component of UCSMP. The resource component's translations include the entire former Soviet Union curriculum (Grades 1-10), standard Japanese texts for Grades 7-11, and innovative textbooks from Hungary and Bulgaria.

The textbooks were originally translated to give US educators and researchers a first-hand look at the content of mathematics instruction in educationally advanced countries. More specifically, they provided input for UCSMP as it developed new instructional strategies, textbooks, and materials of its own. The translation series texts were critical materials in the foundational planning for *Everyday Mathematics*.

For more information on the Resource Development Component at the UCSMP:
http://socialsciences.uchicago.edu/ucsmp/Res_Dev.html (Link is case sensitive).

Effective Classroom Practices – A Selected Annotated Bibliography

A research-based program should furnish instruction that reflects current and validated pedagogical elements, identified though studies and evaluations of instructional methods. The studies listed below are representative and serve as the cornerstones of instruction found in *Everyday Mathematics*. The authors continue to update the program as new studies and research on instructional methods become available.

Bergeron, J.C., & Herscovics, N. (1990). Psychological aspects of learning early arithmetic. In P. Nesher. & J. Kilpatrick (Eds.), *Mathematics and cognition: A research synthesis by the International Group for the Psychology of Mathematics Education* (pp. 31-52). Cambridge, England: Cambridge University Press.

Reports on a study based on the assumption that mathematics is a way of thinking that includes higher mental processes. Through case studies, concludes (1) that mathematics is a thinking process, not skills mastery; (2) that children possess a greater knowledge of mathematics than was previously accepted; and (3) that if teachers realize that children are capable of more challenging mathematics, the focus will change from the end result to the thought process.

Carpenter, T.P. & Moser, J.M. (1984). The acquisition of addition and subtraction concepts in grades one through three. *Journal for Research in Mathematics Education,* 15, 179-202.

Reports on a study of problem solving techniques in first, second, and third grade children. Suggests that teaching addition and subtraction concepts should allow for the natural progression of problem solving skills, rather than moving directly from modeling to memorization. Argues that instruction should be arranged to allow for a child's informal mathematical knowledge.

Pollak, H.O. (1987). The mathematical sciences curriculum K-12: What is still fundamental and what is not. Reprinted in T.A. Romberg & D.M. Stewart (Eds.), *The monitoring of school mathematics: Background papers* (pp. 117-133). Madison, WI: Wisconsin Center for Education Research.

Recommends the following modifications in mathematics education: (1) introduce calculators and computers as early as possible; (2) emphasize mental arithmetic, estimation, and approximation instead of physical execution of arithmetic operations; (3) include experience with collection and analysis of data; (4) include new topics in secondary school curriculum; and (5) regard discrete mathematics, statistics and probability, and computer science as fundamental to the curriculum.

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

Reports on a study of students with learning disabilities and at-risk students using the *Everyday Mathematics* curricula. Proposes a reassessment of previously used special education techniques. Demonstrates that the *Everyday Mathematics* curriculum has many benefits for special needs students in general education classes, including long-term educational success in mathematics and inclusion in a general education classroom.

Other research informing *Everyday Mathematics* curriculum design:

Baroody, A.J., & Ginsburg, H.P. (1986). The relationship between initial meaning and mechanical knowledge of arithmetic. In J. Hiebert (Ed.), *Conceptual and procedural knowledge: The case of mathematics* (pp. 75-112). Hillsdale, NJ: Erlbaum.

Brown, J.S., & Burton, R.R. (1978). Diagnostic models for procedural bugs in basic mathematical skills. *Cognitive Science*, 2, 155-192.

Caple, C. (1996). *The effects of spaced practice and spaced review on recall and retention using computer assisted instruction.* Ann Arbor, MI: UMI.

Carpenter, T.P. (1986). Conceptual knowledge as a foundation for procedural knowledge. In J. Hiebert (Ed.), *Conceptual and procedural knowledge: The case of mathematics* (pp. 113-132). Hillsdale, NJ: Erlbaum.

Cook, C.J., & Dossey, J.A. (1982). Basic fact thinking strategies for multiplication-revisited. *Journal for Research in Mathematics Education*, 13, 163-171.

Flanders, J.R. (1987). How much of the content in mathematics textbooks is new? *Arithmetic Teacher*, 35, 18-23.

Gelman, R. (1982). Basic numerical abilities. In R.J. Sternberg (Ed.), *Advances in the psychology of human intelligence* (pp. 181-205). Hillsdale, NJ: Erlbaum.

Hiebert, J. (1984). Children's mathematics learning: The struggle to link form and understanding. *Elementary School Journal*, 84, 497-513.

Lesh, R., Post, T., & Behr, M. (1987). Representations and translations among representations in mathematics learning and problem solving. In C. Janvier (Ed.), *Problems of representation in the teaching and learning of mathematics* (pp. 33-40). Hillsdale, NJ: Erlbaum.

Resnick, L.B. (1987). Presidential address: Learning in school and out. *Educational Researcher*, 16, 13-20.

Resnick, L.B., Lesgold, S., & Bill, V. (1990). *From protoquantities to number sense*. A paper prepared for the Psychology of Mathematics Education Conference, Mexico City.

Schoenfeld, A. H. (2002). Making mathematics work for all children: Issues of standards, testing, and equity. *Educational Researcher*, 31 (1): 13-25.

Skemp, R.R. (1978). Relational understanding and instrumental understanding. *Arithmetic Teacher*, 26, 9-15.

Stigler, J.W., & Perry, M. (1988). Mathematics learning in Japanese, Chinese, and American classrooms. In G.B. Saxe & M. Gearhart (Eds.), *Children's Mathematics: New Directions for Child Development* (pp. 27-54). San Francisco: Jossey Bass.

Stigler, J.W., Fuson, K.C., Ham, M., & Kim, M.S. (1986). An analysis of addition and subtraction word problems in American and Soviet elementary mathematics textbooks. *Cognition and Instruction*, 3, 153-171.

Walsh, D.J. (1991). Extending the discourse on developmental appropriateness: A developmental perspective. *Early Education and Development*, 2, 109-119.

Field Testing Studies – A Selected Annotated Bibliography

The procedures used to create research-based programs should ensure that every lesson works in actual classrooms. *Everyday Mathematics* was created in a process of systematic field-testing and revision that lasted from 1986 to 1996. Each grade of the program was first drafted, then field tested under controlled conditions with rigorous and systematic procedures for gathering and analyzing implementation and achievement data, and then revised on the basis of empirical findings from the field test.

The University of Chicago School Mathematics Project (UCSMP), which created the *Everyday Mathematics* curriculum, produced a series of reports based on these field test studies. Reports from these formative evaluation studies were used to inform the revision of the draft materials.

In addition to formative evaluation studies carried out during field testing, summative evaluation studies of *Everyday Mathematics* were carried out by UCSMP as each grade was completed. These summative evaluation studies relied largely on matched comparison groups in a quasi-experimental design using instruments of proven validity and reliability. Many of these summative evaluation studies have been published in the peer-reviewed literature.

Carroll, W.M. (2000b). Invented computational procedures of students in a standards-based curriculum. *Journal of Mathematical Behavior,* 18, 111-121.

Reports on a study involving fourth-graders who, since kindergarten, had been in a standards-based curriculum emphasizing student-invented procedures and discussions of problem-solving methods. Demonstrates (1) that students' computations used both invented and standard algorithms, and (2) that students' scores were above normative levels.

Carroll, W.M. (1997). Results of third-grade students in a reform curriculum on the Illinois state mathematics test. *Journal for Research in Mathematics Education,* 28, 237-242.

Reports on a study to measure the performance of third-graders in *Everyday Mathematics* classrooms on Illinois standardized tests. Notes that 23 of 26 schools tested scored above the state mean scores. Concludes that a reform-based curriculum may translate well to traditional assessment measures.

Carroll, W.M. (1996a). Mental computation of students in a reform-based mathematics curriculum. *School Science and Mathematics,* 96, 305-311.

Reports on a study comparing mental computations of fifth-graders in reform-based and traditional curricula. Results demonstrate that students in the reform-based curriculum performed much higher than those in the traditional curriculum, indicating that a reform-based curriculum leads to a better ability to compute mentally.

Carroll, W.M. (1996b). Use of invented algorithms by second graders in a reform mathematics curriculum. *Journal of Mathematics Behavior,* 15, 137-150.

Reports on a study of how instruction influences the use of invented algorithms and mental math. Results suggest that, while all second-grade students tested used mental procedures and standard algorithms, students whose teachers emphasized the use of standard algorithms (1) used standard algorithms more than mental procedures, and (2) were less accurate than students who were encouraged to explore many problem-solving options.

Other field testing studies informing *Everyday Mathematics* curriculum design:

Carroll, W. M. (1998). Polygon capture: A geometry game. *Mathematics Teaching in the Middle School*, 4 (2): 90-94.

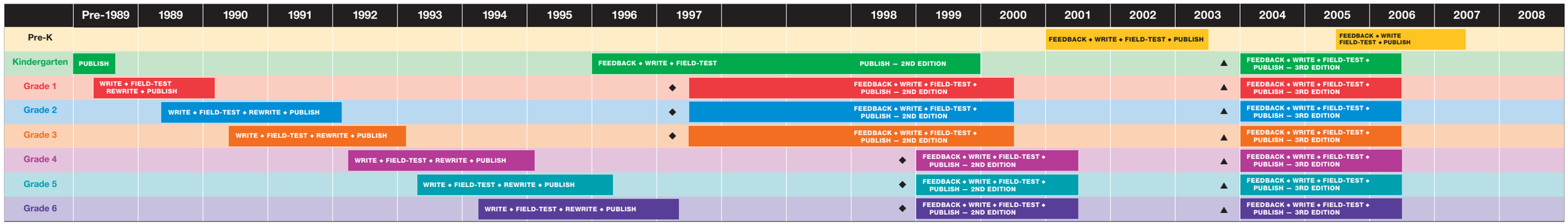
Carroll, W. M. (1997). Mental and written computation: Abilities of students in a reform-based curriculum. *The Mathematics Educator*, 2 (1): 18-32.

Carroll, W., & Porter, D. (1998). Alternative algorithms for whole-number operations. In L. J. Morrow (Ed.), *The teaching and learning of algorithms in school mathematics: 1998 yearbook* (pp. 106-114). Reston, VA: National Council of Teachers of Mathematics.

Carroll, W., & Porter, D. (1997). Invented algorithms can develop meaningful mathematical procedures. *Teaching Children Mathematics 3*(7): 370-74.

Hedges, L. V., Stodolsky, S. S., & Mathison, S. (1987). A Formative Evaluation of *Kindergarten Everyday Mathematics.* UCSMP Evaluation Report #86/87-KEM-1.

Everyday Mathematics Timeline of Research and Development



Learner Verification and Evaluation Studies

Rigorous research has been conducted to study the effectiveness of *Everyday Mathematics*. These evaluations have been consistently positive and guarantee that *Everyday Mathematics* has been proven effective in real classrooms with real students.

The Northwestern Longitudinal Study – A Selected Annotated Bibliography

Everyday Mathematics was the focus of a five-year longitudinal study of the curriculum designed and conducted by researchers at Northwestern University. This longitudinal study used a variety of instruments and observational methods. Items on written tests were drawn from the National Assessment of Educational Progress (NAEP), from international studies of mathematics achievement, and from the research literature; some items were also specially designed for the longitudinal study. Student and teacher interviews, classroom observations, written tests and surveys, and collected artifacts were used in the longitudinal study.

Carroll, W.M. (2000a). A longitudinal study of children in the *Everyday Mathematics* curriculum. Chicago, IL: UCSMP.

Discusses a longitudinal study of the relationship of the *Everyday Mathematics* curriculum to the NCTM standards and other reforms in mathematics education. Compares *Everyday Mathematics* students with Japanese, Chinese and other U.S. students. The project found that *Everyday Mathematics* students outperformed comparison students in the United States across all grades and raised achievement to levels approaching that of high-performing Asian countries.

The project found that *Everyday Mathematics* students outperformed comparison students in the United States across all grades and raised achievement to levels approaching that of high-performing Asian countries.

Carroll, W.M., Fuson, K.C., & Diamond, A. (2000). Use of student-constructed number stories in a reform-based curriculum. *Journal of Mathematical Behavior*, 19, 49-62.

Reports on a study of first-grade students generating and solving addition and subtraction number stories. Finds (1) that students were successful in generating and solving the number stories using many solution methods; (2) that teachers in one quarter of the classrooms failed to link the stories to mathematical representations; and (3) that only half of the teachers discussed solution methods. Implies that teacher instruction and goals are vital to reform-curricula success.

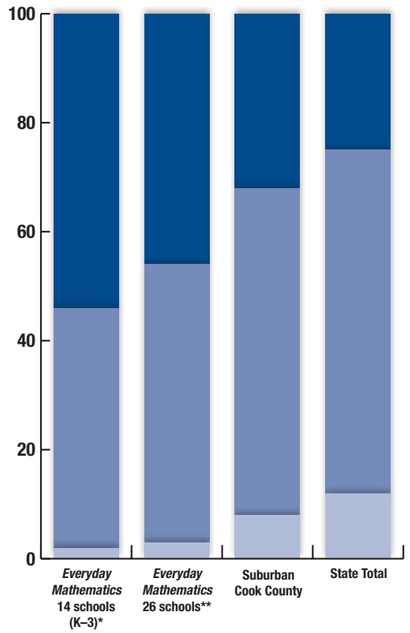
Fraivillig, J.L., Murphy, L.A., & Fuson, K.C. (1999). Advancing children's mathematical thinking in *Everyday Mathematics* classrooms. *Journal for Research in Mathematics Education,* 30, 148-170.

Posits use of the Advanced Children's Thinking framework, a framework for teachers comprised of (1) eliciting solution methods; (2) supporting conceptual understanding; and (3) extending mathematical thinking. Reports on a study of five *Everyday Mathematics* teachers which finds that teachers often support children's thinking but less often elicit or extend children's mathematical thinking.

Fuson, K.C., Carroll, W.M., & Drueck, J. V. (2000). Achievement results for second and third graders using the standards-based curriculum *Everyday Mathematics. Journal for Research in Mathematics Education,* 3, 277-295.

Reports on a study of second and third grade students using *Everyday Mathematics*. Finds that *Everyday Mathematics* students (1) are performing at normative levels for multi-digit addition and subtraction on traditional, reform-based, and *Everyday Mathematics* specific test items, and (2) outperform traditionally taught U.S. students.

ACHIEVEMENT OF STUDENTS USING *EVERYDAY MATHEMATICS*



Percent at each level of competence on the 1993 Illinois mathematics test - Grade 3

At the 14 schools where students had used the curriculum since kindergarten, more than half of the students exceeded the state goals, and only 2% failed to meet the goals. A much higher percentage of *Everyday Mathematics* students exceeded the state goals, and a lower percentage failed to meet the state goals, as compared to the state and Cook County data.

- **Percent Exceeding Goals**
- **Percent Meeting Goals**
- **Percent Not Meeting Goals**

* Represents 14 schools that had implemented *Everyday Mathematics* since Kindergarten

** Represents all 26 schools using *Everyday Mathematics* including 12 that had adopted the program in either second or third grade

Other Northwestern longitudinal studies informing *Everyday Mathematics* curriculum design:

Ding, D. (1997). *Classroom discourse in second-grade reform mathematics classrooms*. Evanston, IL: Northwestern University.

Druek, J. (1996). *Progression of multidigit addition and subtraction solution methods in high-, average-, and low-math-achieving second graders experiencing a reform curriculum.* A paper presented at the annual meeting of the American Educational Research Association.

Fraivillig, J. L. (2001). Strategies for advancing children's mathematical thinking. *Teaching Children Mathematics*, 7 (8): 454-459.

Fraivillig, J. (1996). Case studies and instructional frameworks of expert reform mathematics teaching. Evanston, IL: Northwestern University.

Fuson, K., Carroll, W. M., & Landis, J. (1996). Levels in conceptualizing and solving addition and subtraction compare word problems. *Cognition and Instruction*, 14 (3): 345-71.

Fuson, K.C., Stigler, J.W., & Bartsch, K. (1988). Grade placement of addition and subtraction topics in Japan, Mainland China, the Soviet Union, Taiwan, and the United States. *Journal for Research in Mathematics Education*, 19, 449-456.

Murphy, L. (1998). *Learning and affective issues among higher- and lower-achieving third-grade students in math reform classrooms: Perspectives of children, parents, and teachers*. Evanston, IL: Northwestern University.

Independent Studies – A Selected Annotated Bibliography

Other evaluations of *Everyday Mathematics* have been carried out. The most important of these are NSF-sponsored Tri-State Achievement Study (2003), Riordan and Noyce (2001), Briars and Resnick (2000), and Baxter, Woodward, and Olson (2001).

Baxter, J.A., Woodward, J., & Olson, D. (2001) Effects of reform-based mathematics instruction on low achievers in five third-grade classrooms. *Elementary School Journal*, 101 (5), 529-547.

Extends an earlier study of learning disabled children using the first edition of third grade *Everyday Mathematics* (Woodward & Baxter, 1997). The current study employed surveys, interviews, and classroom observations to examine the difficulties low-achieving student face when working with reform-based mathematics curricula, and identified the formation of a community of learners and the cognitive load as key features of the curriculum that need to be considered in relation to low achievers. Concludes that reform-based mathematics should not be abandoned when teaching low achievers.

Institute of Education Sciences, U.S Department of Education. (2006). What Works Clearinghouse Intervention Report Elementary School Math. Washington, DC: Author.

The What Works Clearinghouse review of elementary school mathematics curriculum-based programs addresses student outcomes in mathematics achievement. *Everyday Mathematics* was found to have potentially positive effects on students' mathematics achievement. Available online at: http://ies.ed.gov/ncee/wwc/reports/elementary_math/eday_math/

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, 368-398.

Reports on a study comparing statewide standardized test scores of fourth-grade students using *Everyday Mathematics* and eighth-grade students using *Connected Mathematics* to scores of similar students using traditional curricula. Finds that students using a standards-based curriculum performed significantly better than those using a traditional-based curriculum. Finds apparent improvements across mathematical strands, question styles, and student populations.

Other independent research studies informing the *Everyday Mathematics* curriculum:

Briars, D. J., & Resnick, L. B. (2000). Standards, assessment—and what else? The essential elements of standards-based school improvement. Los Angeles: Center for the Study of Evaluation, UCLA. (http://www.cse.ucla.edu/products/Reports/TECH528.pdf)

Hawkes, M., Kimmelman, P., & Kroeze, D. (1997). Becoming 'first in the world' in math and science. *Phi Delta Kappan*, 79 (1): 30-33.

Kroeze, D. J., Johnson, D. P, & Zalewski, E. (1997). Achieving excellence: A report of initial findings of eighth grade performance from the Third International Mathematics and Science Study: First in the World Coalition. Oak Brook, IL: North Central Regional Educational Laboratory.

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. Ann Arbor, Michigan: UMI.

TRI-STATE STUDENT ACHIEVEMENT STUDY

In 2003, the ARC Center, located at the Consortium for Mathematics and its Applications (COMAP), completed a study of the effects of standards-based mathematics programs on student performance on state-mandated standardized tests in Massachusetts, Illinois, and Washington. The National Science Foundation funded this study and its report.

The findings in this report are based on the records of over 78,000 students: 39,701 who had used the *Everyday Mathematics* curriculum for at least two years, and 38,481 students from comparison schools. The students were carefully matched by reading level, socioeconomic status, and other variables.

Results showed that the average scores of students in the *Everyday Mathematics* schools were consistently higher than the average scores of students in the comparison schools. The results hold across different state-mandated tests and across topics ranging from computation, measurement, and geometry to algebra, problem-solving, and making connections. (A complete report is available from COMAP or Wright Group/McGraw-Hill.)

Available online at: http://www.comap.com/elementary/projects/arc/

Evidence of Effectiveness in User Schools and Districts

Since *Everyday Mathematics* is so widely used — over four million students use the program nationwide — many school districts have studied its effects on student achievement. Such school district studies typically report the results of paper-and-pencil tests, usually commercial norm-referenced tests or mandated state assessments. Surveys of teachers, parents, and students are also often included in district program evaluations.

New York City Department of Education. (2009). New York City Results on the New York State Mathematics Test (Grades 3 -8). New York, NY: Author. Available online at http://schools.nyc.gov/Accountability/YearlyTesting/TestResults/MathTestResults/default.htm

Wright Group/McGraw-Hill. (2007). *Everyday Mathematics Student Achievement Studies, volume 6.* Chicago: Author.

Numerous districts have shared test data and have offered their insights into implementation and professional development through *Everyday Mathematics* Success Stories. A few of the districts that have shared their evidence of increased achievement are listed below.

Anchorage, Alaska
Burnsville, Minnesota
Citrus County, Florida
Daviess County, Kentucky
Fayetteville, Arkansas
Glendale, California
Horry County, South Carolina
Ka'ala, Hawaii
Lapwai, Idaho
Michigan City, Indiana
Montgomery Area SD, Pennsylvania
Montgomery County, Virginia
New York City, New York
Norman, Oklahoma
Orange County, Florida
Philadelphia, Pennsylvania
Plainfield, Illinois
Union County, Oklahoma
Virginia Beach, Virginia
Winchester, Massachusetts

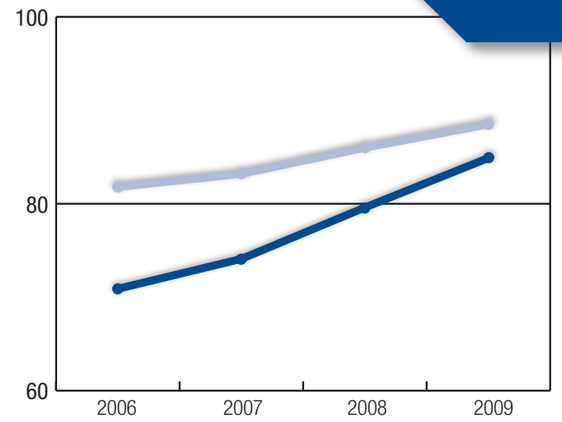
Summary reports detailing the most recent student achievement results on state mathematics tests in six nationally representative districts are presented on the next two pages.

For more information on a variety of *Everyday Mathematics* Success Stories and Evidence of Student Achievement, please visit http://www.EverydayMathSuccess.com.

New York City Public Schools
Grade 4 Students Performing at Levels 3 and 4

Students in New York City Public Schools are improving their performance on the New York State Mathematics Assessments at a higher rate than the rest of the state. Since 2006, Grade 4 students in NYC have improved 14 percentage points, compared to a gain of 6.7 percentage points in the rest of the state, closing the achievement gap to only 3.6 points.

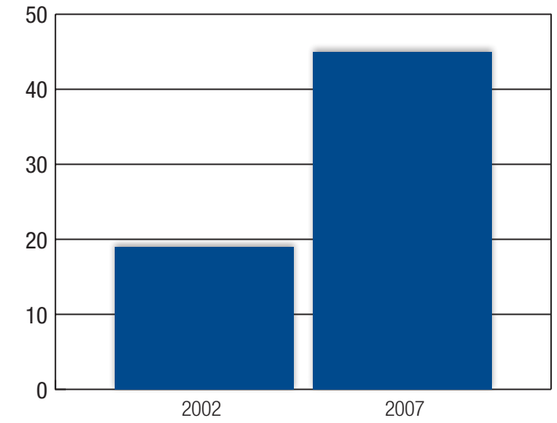
District Demographic Profile:
Number of students: 1,100,000
African-American: 35%
Asian: 14%
Hispanic: 37%
White: 14%
Free or Reduced-Price Meals: 81%



School District of Philadelphia
Grade 5 - PSSA Mathematics Results

The share of students in Philadelphia schools who score in the Advanced and Proficient categories on PSSA mathematics tests has more than doubled since 2002, representing real success in the district.

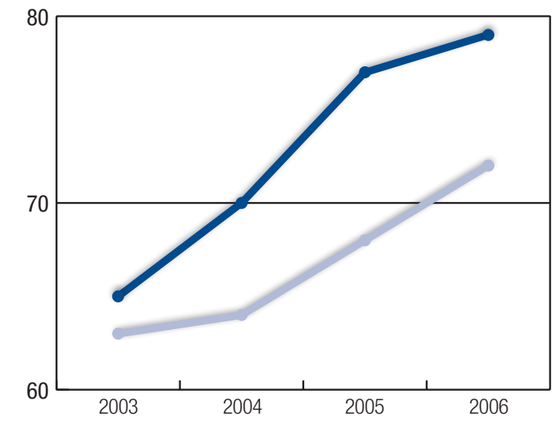
District Demographic Profile:
Number of students: 184,500
African-American: 64%
Asian: 6%
Hispanic: 16%
White: 13%
Free or Reduced-Price Meals: 76%



Citrus County School District
Grade 3 FCAT Mathematics - % Met Standards

In Grade 3, 79% of students met the state standards in mathematics on the 2006 FCAT compared to 72% of the state total. In addition, Citrus County logged a 14 percentage point increase in the share of third graders who met mathematics standards since 2003.

District Demographic Profile:
Number of students: 16,500
African-American: 4%
Hispanic: 4%
White: 87%
Free or Reduced-Price Meals: 49%

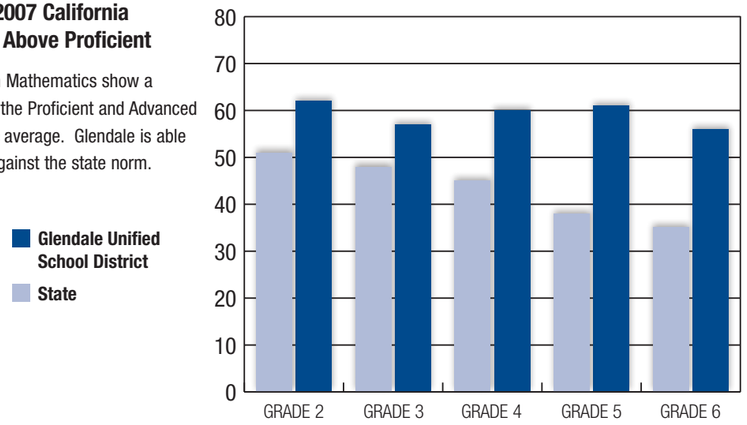


Glendale Unified School District 2007 California Standards Test Results - % At or Above Proficient

Results on the California Standards Test in Mathematics show a consistent rate of student performance at the Proficient and Advanced levels in Grades 2–6, surpassing the state average. Glendale is able to maintain and show continued growth against the state norm.

District Demographic Profile:

Number of students: 25,000
Asian: 19%
Hispanic: 23%
White: 57%
Free or Reduced-Price Meals: 22%

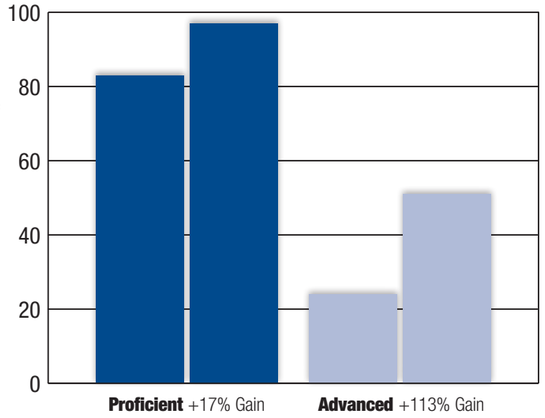


Norman Public Schools Grade 5 OK Core Curriculum Math Test % Advanced and Proficient

After adopting Everyday Mathematics in the fall of 2004, students have continually improved their achievement on state tests. By 2008, 51% of 5th graders were scoring at an Advanced Level, an improvement of 113%.

District Demographic Profile:

Number of students: 14,000
African-American: 7%
Hispanic: 6%
White: 75%
Free or Reduced-Price Meals: 40%+

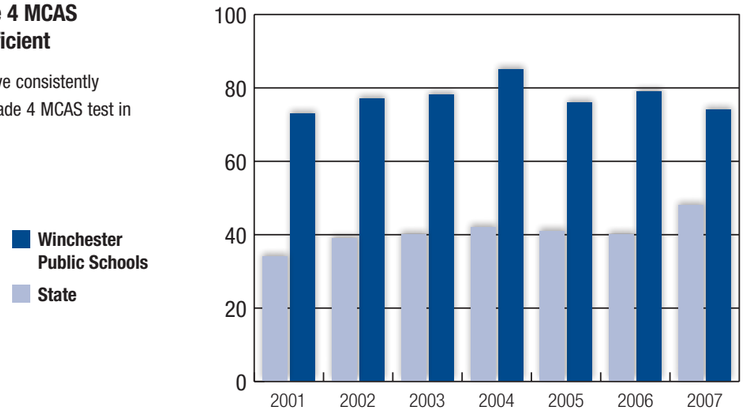


Winchester Public Schools Grade 4 MCAS Mathematics % Advanced & Proficient

Students in Winchester Public Schools have consistently outperformed the state average on the Grade 4 MCAS test in mathematics.

District Demographic Profile:

Number of students: 4,000
Asian: 7%
White: 87%
Special Education: 15%



Conclusion

Everyday Mathematics is based on research and has been validated by research. Across this research, a wide range of instruments and methodologies have been employed to measure students' progress and understanding, providing a broad perspective on which to evaluate the effects of the curriculum. Methods used include a variety of effective research designs, including pre-post comparisons, quasi-experimental designs, longitudinal studies, and observational studies, all with appropriate controls and statistical analyses. Studies range from intensive observations in a small number of classrooms to large-scale studies of tens of thousands of children. These studies began in the late 1980s and continue to this day.

The results of these many studies indicate the following:

- On more traditional topics, such as fact knowledge and paper-and pencil computation, *Everyday Mathematics* students perform as well as or better than students in more traditional basal programs. In addition, *Everyday Mathematics* students use a greater variety of computation solution methods. Students are especially strong on mental computation.
- On topics that have been underrepresented in the elementary curriculum – geometry, data, measurement, and algebra – *Everyday Mathematics* students score substantially higher that do students in more traditional programs. *Everyday Mathematics* students also generally perform better on questions that assess problem solving, reasoning, and communication.
- Improvements in performance for students using the *Everyday Mathematics* curriculum cut across racial, ethnic, and income-level categories.

The What Works Clearinghouse (WWC), within the US Department of Education, reported in 2006 on the effects of elementary school mathematics programs on student outcomes in math achievement. In rating the effectiveness of any curriculum, the What Works Clearinghouse considers only those research studies that meet a "gold standard" for scientifically based research. The elementary mathematics review included *Everyday Mathematics* as well as traditional basal textbook series and a skills-based alternative basal.

The WWC considered for evidence of effectiveness four studies of *Everyday Mathematics* that included a total of approximately 12,600 students in grades 3-5 from a range of socioeconomic backgrounds and attending schools in urban, suburban, and rural communities in multiple states. The WWC considered the extent of evidence for *Everyday Mathematics* to be moderate to large.

On more traditional topics, such as fact knowledge and computation, *Everyday Mathematics* students perform as well as or better than students in more traditional programs. On topics that have been underrepresented at the elementary level—geometry, measurement, algebra—*Everyday Mathematics* students score substantially higher.

Additionally, *Everyday Mathematics* received an effectiveness rating from the WWC of "potentially positive effects" on students' math achievement. All of the other elementary school mathematics programs reviewed by the WWC received effectiveness ratings of "no discernible effects."

The *Everyday Mathematics* development team at UCSMP currently includes a full-time statistician who directs the analysis of data from student testing, teacher surveys, and classroom observations. The scientific research basis for *Everyday Mathematics* is solid.

For more information about *Everyday Mathematics*, call 1-800-648-2970 or visit EverydayMath.com.

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