WWC Intervention Report

A summary of findings from a systematic review of the evidence

INSTITUTE OF EDUCATION SCIENCES

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University of Chicago School Mathematics Project (UCSMP)

Report Contents

This intervention report presents findings from a systematic review of *USCMP* conducted using the WWC Procedures and Standards Handbook, version 3.0, and Secondary Mathematics review protocol, version 3.1.

Program Description[1]

University of Chicago School Mathematics Project (UCSMP) is a core mathematics curriculum that emphasizes problem solving, real-world applications, and the use of technology. The curriculum is based on a student-centered approach with a focus on active learning that incorporates reading and uses a flexible lesson organization. This review focuses on studies of the following secondary courses: *Algebra; Geometry; Advanced Algebra; Functions, Statistics, and Trigonometry;* and *Precalculus and Discrete Mathematics.*

Research[2]

The What Works Clearinghouse (WWC) identified two studies of *UCSMP Algebra* and one study of the cumulative effect of *multiple UCSMP courses* that both fall within the scope of the Secondary Mathematics topic area and meet WWC group design standards. No studies meet WWC group design standards without reservations, and two studies of *UCSMP Algebra* meet WWC group design standards with reservations. Together, these two studies included 225 students in grades 8–12 in three locations. The one study of *multiple UCSMP courses* also meets WWC group design standards with reservations. This study included 62 students in grades 7–10 in two locations.

The WWC considers the extent of evidence for *UCSMP Algebra* on the mathematics achievement of secondary students to be small for two outcome domains—general mathematics achievement and algebra. The WWC considers the extent of evidence for *multiple UCSMP courses* on the mathematics achievement of secondary students to be small for one outcome domain—general mathematics achievement. There were no studies that meet WWC group design standards in the four remaining domains, so this intervention report does not report on the effectiveness of *UCSMP* for those domains. (See the Effectiveness Summary on p. 6 for more details of effectiveness by domain.)

The findings in this report pertain to *UCSMP Algebra* and the cumulative effect of *multiple UCSMP courses*. No studies that independently examine *UCSMP Geometry; UCSMP Advanced Algebra; UCSMP Functions, Statistics, and Trigonometry;* or *UCSMP Precalculus and Discrete Mathematics* fall within the scope of the Secondary Mathematics review protocol and meet WWC group design standards.

Effectiveness

UCSMP Algebra was found to have potentially positive effects on general mathematics achievement and algebra for secondary students.

The cumulative effect of *multiple UCSMP courses* was found to have potentially positive effects on general mathematics achievement for secondary students.

Table 1. Summary of findings[3]

Course and outcome domain	Rating of effectiveness	Improvement index (percentile points)		Number of studies	Number of students	Extent of evidence
		Average	Range			
UCSMP Algebra						
General mathematics achievement	Potentially positive effects	+29	na	1	189	Small
Algebra	Potentially positive effects	+7	–6 to +20	2	225	Small
Multiple UCSMP courses						
General mathematics achievement	Potentially positive effects	+23	na	1	62	Small
UCSMP Geometry	No evidence					
UCSMP Advanced Algebra	No evidence					
UCSMP Functions, Statistics, and Trigonometry	No evidence					
UCSMP Precalculus and Discrete Mathematics	No evidence					

na = not applicable

Program Information

Background

UCSMP was developed by the University of Chicago and is published by the University of Chicago School Mathematics Project. Address: 1225 East 60th Street, Chicago, IL 60637. Email: ucsmp@uchicago.edu. Web: http://ucsmp.uchicago.edu. Telephone: (773) 702-1130. Fax: (773) 702-3114.

Program details

UCSMP was designed to support student development of deeper conceptual mathematical understanding. To that end, the curriculum presents students with challenging mathematics and aids in student acquisition of skills and concepts. The curriculum focuses on bringing the real world into the classroom by emphasizing reading, problem solving, everyday applications, and the use of calculators, computers, and other technologies. Repetition and review are used sparingly.

Each *UCSMP* course includes a student textbook, teacher's edition, teacher resources, assessment resources, and technology resources. Lessons in the student book contain activities, full examples, and partially completed guided examples to model skills and problem solving. Students are encouraged to assess their own understanding with an End-of-Chapter Self-Test correlated to objectives. Projects provided at the end of each chapter are designed as extended activities, giving students experience using real data. The use of technology—including graphing calculators at all grade levels, geometry systems, spreadsheets, the Internet, and other computer applications—is an essential component of the curriculum.

The publisher is currently selling the third edition of *UCSMP*. The publisher's website describes how the curriculum has been refined and enhanced from the first and second editions.

Cost

The cost of *UCSMP* varies by course, each of which can be purchased individually. As of December 2015, the prices for the student edition of each course ranged from $69.00 to $72.00, the teacher's edition cost $119.00, the teacher's resources cost $89.00, the assessment resources cost $89.00, the electronic teacher's edition cost $119.00, the Teacher's Assessment Assistant cost $89.00, and the ExamView® Assessment Suite cost $89.00. These prices are based on quantities of up to 150 for each course; prices could vary for quantities greater than 150. More cost information is available from the publisher's website.

Research Summary

This research summary includes information from studies of all available *UCSMP* courses for secondary students.

The WWC identified 12 studies that were eligible for review:

- Three eligible studies investigated the effects of *UCSMP Algebra* on the mathematics achievement of secondary students.
- Four eligible studies investigated the cumulative effect of 4 years of *multiple UCSMP courses* (including *UCSMP Transition Mathematics*, *UCSMP Algebra*, *UCSMP Geometry*, and *UCSMP Advanced Algebra*) on the mathematics achievement of secondary students.
- Five eligible studies investigated the effects of *UCSMP Geometry; UCSMP Advanced Algebra*; *UCSMP Functions, Statistics, and Trigonometry;* and *UCSMP Precalculus and Discrete Mathematics* on the mathematics achievement of secondary students.[4]

Table 2. Scope of reviewed research

Grade	7–12
Delivery method	Whole class
Program type	Curriculum

The WWC reviewed the 12 eligible studies against group design standards. None of the 12 studies are randomized controlled trials that meet WWC group design standards without reservations. Three of the 12 studies are randomized controlled trials or quasi-experimental designs that meet WWC group design standards with reservations. Those three studies focus on *UCSMP Algebra* and *multiple UCSMP courses* and are summarized in this report. The remaining nine studies do not meet WWC group design standards.

An additional 44 studies were identified but do not meet WWC eligibility criteria for review in this topic area. Citations for all 56 studies are in the References section, which begins on p. 8.

Summary of studies of *UCSMP Algebra* meeting WWC group design standards without reservations

No studies of *UCSMP Algebra* met WWC group design standards without reservations.

Summary of studies of *UCSMP Algebra* meeting WWC group design standards with reservations

Peters (1992) conducted a randomized controlled trial in which the integrity of random assignment was compromised because some students did not remain in the study group to which they were randomly assigned—students were reallocated between the intervention and comparison groups to accommodate scheduling difficulties and student requests for other course offerings. The study demonstrated baseline equivalence on the analysis sample and therefore, *meets WWC group design standards with reservations*. The study investigated the effect of *UCSMP Algebra* on the mathematics achievement of 36 "math talented" eighth-grade students (17 *UCSMP Algebra* and 19 comparison) from one junior high school in Nebraska during the 1991–92 school year. The district borders two large cities, and its students lived in rural and suburban areas. Students in the intervention group used the *UCSMP Algebra I* first-edition textbook, while students in the comparison group used *Saxon Algebra I*.

Thompson et al. (2006) used students' mathematics ability to match six pairs of classrooms within three schools to evaluate the effectiveness of the second edition of *UCSMP Algebra*. Within each pair, random assignment of classrooms to the intervention or comparison condition was not always possible; therefore, this study is treated as a quasi-experimental design. The WWC review focuses on the three high schools (X, Y, and Z in the study) that compared the use of the *UCSMP* (second edition) to that of non-*UCSMP* textbooks.[5] These three high schools, located in three different regions of the country and serving three different populations of students, contributed 189 ninth- through twelfth-grade students to the analysis (85% of the students were in ninth grade).

Summary of studies of *multiple UCSMP courses* meeting WWC group design standards without reservations

No studies of *multiple UCSMP courses* met WWC group design standards without reservations.

Summary of study of *multiple UCSMP courses* meeting WWC group design standards with reservations

Hirschhorn (1993) conducted a longitudinal, 4-year quasi-experimental evaluation of *UCSMP* (first edition) in three high schools in which both traditional and *UCSMP* curricula were used. Every student in the intervention group received 4 years of *UCSMP* curricula, starting with *Transition Mathematics* in seventh grade and ending with *UCSMP Advanced Algebra* in tenth grade. No student in the comparison group participated in any *UCSMP* courses. Intervention students were matched to potential comparison students retrospectively using pretest (sixth grade) scores, and outcomes were measured at the end of the 4-year period (tenth grade). Two high schools (B and C in the study) contributed 62 students to the analysis. A third high school (A in the study) is excluded from the WWC review because baseline equivalence between the intervention and comparison groups could not be established.

Effectiveness Summary

The WWC review of *UCSMP Algebra* and *multiple UCSMP courses* for the Secondary Mathematics topic area includes student outcomes in six domains: general mathematics achievement; algebra; geometry; statistics and probability; trigonometry/precalculus; and calculus. The two studies of *UCSMP Algebra* that meet WWC group design standards reported findings in two of the six domains: general mathematics achievement and algebra. The one study of *multiple UCSMP courses* that meets WWC group design standards reported findings in one of the six domains: general mathematics achievement. The findings below present the authors' estimates and WWC-calculated estimates of the size and statistical significance of the effects of *UCSMP Algebra* and *multiple UCSMP courses* on secondary students. For a more detailed description of the rating of effectiveness and extent of evidence criteria, see the WWC Rating Criteria on p. 24.

Summary of *UCSMP Algebra* effectiveness for the general mathematics achievement domain

Table 3. Rating of effectiveness and extent of evidence of *UCSMP Algebra* for the general mathematics achievement domain

Rating of effectiveness	Criteria met
Potentially positive effects *Evidence of positive effects with no overriding contrary evidence.*	In the one study that reported findings, the estimated impact of the intervention on outcomes in the *general mathematics achievement* domain was a statistically significant positive effect. No studies showed a statistically significant or substantively important negative effect.
Extent of evidence	**Criteria met**
Small	One study that included 189 students in three schools reported evidence of effectiveness in the *general mathematics achievement* domain.

One study of *UCSMP Algebra* that meets WWC group design standards with reservations reported findings in the general mathematics achievement domain.

Thompson et al. (2006) found, and the WWC confirmed (after applying a correction for classroom-level clustering), one positive and statistically significant difference between the *UCSMP Algebra* and comparison groups in the general mathematics achievement domain. The WWC characterizes this study finding as a statistically significant positive effect.

Thus, for the general mathematics achievement domain, one study of *UCSMP Algebra* showed a statistically significant positive effect. This results in a rating of potentially positive effects, with a small extent of evidence.

Summary of *UCSMP Algebra* effectiveness for the algebra domain

Table 4. Rating of effectiveness and extent of evidence of *UCSMP Algebra* for the algebra domain

Rating of effectiveness	Criteria met
Potentially positive effects *Evidence of positive effects with no overriding contrary evidence.*	In the two studies that reported findings, the estimated impact of the intervention on outcomes in the *algebra* domain was: one study showing a statistically significant positive effect and one study showing an indeterminate effect.
Extent of evidence	**Criteria met**
Small	Two studies that included 225 students in four schools reported evidence of effectiveness in the *algebra* domain.

Two studies of *UCSMP Algebra* that meet WWC group design standards with reservations reported findings in the algebra domain.

Peters (1992) found, and the WWC confirmed (using a difference-in-differences approach), no statistically significant differences between the *UCSMP Algebra* and comparison groups in the algebra domain. The WWC characterizes these study findings as an indeterminate effect.

Thompson et al. (2006) found a positive and statistically significant difference between the *UCSMP Algebra* and comparison groups on the odd and even forms of the *UCSMP* Problem-Solving and Understanding Test, analyzed separately. The WWC confirmed this finding, pooling the results from both versions of the form into one statistically significant positive effect (after applying a correction for clustering). As a result, Thompson et al. (2006) reported, and the WWC confirmed (after correction for clustering), a positive and statistically significant difference between the *UCSMP Algebra* and comparison groups in the algebra domain. The WWC characterizes these study findings as a statistically significant positive effect.

Thus, for the algebra domain, one study of *UCSMP Algebra* showed a statistically significant positive effect and one study showed an indeterminate effect. This results in a rating of potentially positive effects, with a small extent of evidence.

Summary of *multiple UCSMP courses* effectiveness for the general mathematics achievement domain

Table 5. Rating of effectiveness and extent of evidence of *multiple UCSMP courses* for the general mathematics achievement domain

Rating of effectiveness	Criteria met
Potentially positive effects *Evidence of positive effects with no overriding contrary evidence.*	In the one study that reported findings, the estimated impact of the intervention on outcomes in the *general mathematics achievement* domain was a statistically significant positive effect. No studies showed a statistically significant or substantively important negative effect.
Extent of evidence	**Criteria met**
Small	One study that included 62 students in one school reported evidence of effectiveness in the *general mathematics achievement* domain.

One study of *multiple UCSMP courses* that meets WWC group design standards with reservations reported findings in the general mathematics achievement domain.

Hirschhorn (1993) found no statistically significant effects in one site, and a positive and statistically significant effect in another, on the Mathematics Level 1 Achievement test. The WWC pooled the results from both sites and found no statistically significant differences between *multiple UCSMP courses* and comparison groups on the test. In addition, Hirschhorn (1993) found statistically significant positive effects in each site on the UCSMP-developed Applications Test, and the WWC confirmed this finding, pooling the results from both sites. Taking the two outcomes together, after adjusting for multiple comparisons, the WWC characterizes this study finding as a statistically significant positive effect.

Thus, for the general mathematics achievement domain, one study of *multiple UCSMP courses* showed a statistically significant positive effect. This results in a rating of potentially positive effects, with a small extent of evidence.

References

Studies of *UCSMP Algebra* that meet WWC group design standards without reservations

None.

Studies of *UCSMP Algebra* that meet WWC group design standards with reservations

Peters, K. G. (1992). *Skill performance comparability of two algebra programs on an eighth-grade population* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 9314428)

Thompson, D. R., Senk, S. L., Witonsky, D., Usiskin, Z., & Kaeley, G. (2006). *An evaluation of the second edition of UCSMP Algebra*. Chicago, IL: University of Chicago School Mathematics Project.

Study of *UCSMP Algebra* that does not meet WWC group design standards

Mathison, S., & University of Chicago School Mathematics Project. (1989). *Teaching and learning algebra: An evaluation of UCSMP Algebra*. Chicago, IL: University of Chicago School Mathematics Project. This study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Studies of *multiple UCSMP courses* that meet WWC group design standards without reservations

None.

Study of *multiple UCSMP courses* that meets WWC group design standards with reservations

Hirschhorn, D. B. (1993). A longitudinal study of students completing four years of UCSMP mathematics. *Journal for Research in Mathematics Education, 24*(2), 136–158.

Additional source:

Hirschhorn, D. B. (1991). *Implementation of the first four years of the University of Chicago School Mathematics Project secondary curriculum* (Unpublished doctoral dissertation). University of Chicago, IL.

Studies of *multiple UCSMP courses* that do not meet WWC group design standards

Davis, J. D., & Shih, J. C. (2007). Secondary options and post-secondary expectations: Standards-based mathematics programs and student achievement on college mathematics placement exams. *School Science and Mathematics, 107*(8), 336–346. This study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

McConnell, J. (1990). *UCSMP sophomores on the PSAT*. Glenview, IL: Glenbrook South High School. This study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Tubbergen, L. (2001). *High school reform math programs: An evaluation for leaders* (Unpublished doctoral dissertation). Eastern Michigan University, Ypsilanti. This study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Studies of *UCSMP Advanced Algebra* that do not meet WWC group design standards

Senk, S. L., & Thompson, D. R. (2006). Strategies used by second-year algebra students to solve problems. *Journal for Research in Mathematics Education, 37*(2), 116–128. This study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Additional source:

Thompson, D. R., & Senk, S. L. (2001). The effects of curriculum on achievement in second-year algebra: The example of the University of Chicago School Mathematics Project. *Journal for Research in Mathematics Education, 32*, 58–85.

Thompson, D. R., Senk, S. L., Witonsky, D., Usiskin, Z., & Kaeley, G. (2001). *An evaluation of the second edition of UCSMP Advanced Algebra*. Chicago, IL: University of Chicago School Mathematics Project. This study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Study of *UCSMP Geometry* that does not meet WWC group design standards

Thompson, D. R., Witonsky, D., Senk, S. L., Usiskin, Z., & Kaeley, G. (2003). *An evaluation of the second edition of UCSMP Geometry*. Chicago, IL: University of Chicago School Mathematics Project. This study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Study of *UCSMP Functions, Statistics, and Trigonometry* that does not meet WWC group design standards

Senk, S. L. (1989). Assessing students' knowledge of functions. In C. A. Mahrer, G. A. Goldin, & R. B. Davis (Eds.), *Proceedings of the eleventh annual meeting of the North American chapter of the International Group for the Psychology of Mathematics Education* (vol. 2). New Brunswick, NJ: Rutgers University. This study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Study of *UCSMP Precalculus and Discrete Mathematics* that does not meet WWC group design standards

Thompson, D. R. (1994). *An evaluation of a new course in precalculus and discrete mathematics* (Unpublished doctoral dissertation). University of Chicago, IL. This study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Studies of *UCSMP* that are ineligible for review using the Secondary Mathematics Evidence Review Protocol

Aydin, N., & Halat, E. (2009). The impacts of undergraduate mathematics courses on college students' geometric reasoning stages. *The Montana Mathematics Enthusiast, 6*(1), 151–164. This study is ineligible for review because it does not use a sample aligned with the protocol.

Balfanz, R., Mac Iver, D. J., & Byrnes, V. (2006). The implementation and impact of evidence-based mathematics reforms in high-poverty middle schools: A multi-site, multi-year study. *Journal for Research in Mathematics Education, 37*(1), 33–64. The study is ineligible for review because it does not use an eligible design.

Bryant, D. P., Bryant, B. R., Gersten, R., Scammacca, N., & Chavez, M. M. (2008). Mathematics intervention for first- and second-grade students with mathematics difficulties: The effects of tier 2 intervention delivered as booster lessons. *Remedial and Special Education, 29*(1), 20–32. This study is ineligible for review because it does not use a sample aligned with the protocol.

Additional source:

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Davis, J. D., Smith, D. O., Roy, A. R., & Bilgic, Y. K. (2014). Reasoning-and-proving in algebra: The case of two reform-oriented U.S. textbooks. *International Journal of Educational Research, 64*, 92–106. The study is ineligible for review because it is out of scope of the protocol.

Fan, L., & Zhu, Y. (2007). Representation of problem-solving procedures: A comparative look at China, Singapore, and US mathematics textbooks. *Educational Studies in Mathematics, 66*(1), 65–75. The study is ineligible for review because it is out of scope of the protocol.

Findell, C. (1996). Mathematics education then and now: The need for reform. *Journal of Education, 178*(2), 3. The study is ineligible for review because it is out of scope of the protocol.

Fraivillig, J. (1996). *Case studies and instructional frameworks of expert reform mathematics teaching* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 9632689) The study is ineligible for review because it does not use an eligible design.

Halat, E. (2007). Reform-based curriculum & acquisition of the levels. *Eurasia Journal of Mathematics, Science and Technology Education, 3*(1), 41–49. This study is ineligible for review because it does not use a sample aligned with the protocol.

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Hauser, L. A. (2015). *Precalculus students' achievement when learning functions: Influences of opportunity to learn and technology from a University of Chicago School Mathematics Project study* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 1677177885) The study is ineligible for review because it does not use an eligible design.

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Thompson, D. R., Senk, S. L., Witonksy, D., Usiskin, Z., & Kealey, G. (2005). *An evaluation of the second edition of UCSMP Transition Mathematics*. Chicago, IL: University of Chicago School Mathematics Project. This study is ineligible for review because it does not use a sample aligned with the protocol.

Thompson, D. R., Senk, S. L., & Yu, Y. (2011). *An evaluation of the Third Edition of the University of Chicago School Mathematics Project Transition Mathematics.* Chicago, IL: University of Chicago School Mathematics Project. The study is ineligible for review because it is out of scope of the protocol.

University of Chicago School Mathematics Project. (2007). Fidelity of implementation in the UCSMP secondary component. *UCSMP Newsletter*, 38. The study is ineligible for review because it is out of scope of the protocol.

University of Chicago School Mathematics Project. (2007). Opportunity to learn: A critical variable in UCSMP curriculum research. *UCSMP Newsletter*, 38. The study is ineligible for review because it does not use an eligible design.

Usiskin, Z. (1986). The UCSMP: Translating grades 7–12 mathematics recommendations into reality. *Educational Leadership, 44*(4), 30. The study is ineligible for review because it is out of scope of the protocol.

Wood, F. R. (2006). *The relationship between the measured changes in mathematics scores of eighth grade New Jersey students and the implementation of a standards-based mathematics program* (Unpublished doctoral dissertation). Widener University, Chester, PA. The study is ineligible for review because it does not use an eligible design.

Yu, Y. (2015). *The influence of types of homework on opportunity to learn and students' mathematics achievement: Examples from the University of Chicago School Mathematics Project* (Doctoral dissertation) Available from ProQuest Dissertations and Theses database. (UMI No. 1727140682) The study is ineligible for review because it does not use an eligible design.

Zhu, Y., & Fan, L. (2006). Focus on the representation of problem types in intended curriculum: A comparison of selected mathematics textbooks from mainland China and the United States. *International Journal of Science and Mathematics Education, 4*(4), 609–626. The study is ineligible for review because it does not use an eligible design.

Appendix A.1: Research details for Peters (1992)

Peters, K. G. (1992). *Skill performance comparability of two algebra programs on an eighth-grade population* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 9314428)

Table A1. Summary of *UCSMP Algebra* findings

Meets WWC group design standards with reservations

		Study findings	
Outcome domain	Sample size	Average improvement index *(percentile points)*	Statistically significant
Algebra	2 classrooms/36 students	–6	No

Setting

The study took place in one junior high school in Nebraska. The district borders two large cities (Lincoln and Omaha) and has a mix of students living in rural and suburban locations.

Study sample

The study included two classrooms of the same eighth-grade teacher (for a total of 36 students) from one junior high school during the 1991–92 school year. All of the students were designated as "math talented" based on teacher recommendations and prior academic achievement; all students scored at or above the 87th percentile on the California Achievement Test total math battery. Of the total sample, 56% were female (53% intervention and 58% comparison) and 44% were male (47% intervention and 42% comparison). Students were randomly assigned to the sole study teacher's two classrooms, so the teacher used the intervention curriculum in one classroom and the comparison curriculum in the other. However, the assignment of students was altered after random assignment to accommodate scheduling difficulties and student requests for other course offerings. The analytic sample included 17 students in the *UCSMP Algebra* group and 19 students in the comparison group.

Intervention group

Students in the intervention group were taught using *UCSMP Algebra* during the 1991–92 school year. *UCSMP Algebra* was developed based on National Council of Teachers of Mathematics (NCTM) objectives. It emphasizes questioning and problem-solving skills, use of technology, use of non-algebraic mathematic topics (e.g., geometry and probability concepts), reading comprehension, and lessons with real-world applications. Lessons are organized into three sections: an introduction of a concept, a reading section with an explanation, and real-life problems.

Comparison group

Students in the comparison group were taught using *Saxon Math Algebra I*. Students participated in daily lessons from the curriculum for 1 academic year. In each lesson, the teacher introduced a new concept incrementally, and students had opportunities to practice new and past concepts. Each lesson was structured to allow 30 minutes of teacher instruction followed by 30 minutes of practice.

Outcomes and measurement

The primary outcome measure was the Orleans-Hanna Algebra Prognosis Test. This measure was administered as a pretest in August 1991 and as a posttest in May 1992. For the pretest measure, the author reported both a standardized score and a raw score. Only the standardized score is used in this review because, per the author, the standardized score allows comparability between the pretest and posttest.

The study also examined four study-generated criterion unit tests designed to descriptively measure student understanding of algebraic components; however, the author did not provide information on the reliability of these four tests. Accordingly, analyses based on these four unit tests are not included in this intervention report. In addition, the study examined students' satisfaction with learning. This outcome is not included in this version of the report because it is not in a domain focused on in the Secondary Mathematics topic area. For a more detailed description of the eligible outcome measure, see Appendix B.

Support for implementation

The teacher who taught both study groups did not have prior experience with the intervention or comparison curricula, but had read extensively about both teaching formats. The teacher participated in a 1-week summer workshop on *UCSMP Algebra*, and in two 1-day workshops given by local consultants on both of the curricula used in this study. The author also conducted weekly monitoring to help maintain implementation integrity.

Appendix A.2: Research details for Thompson et al. (2006)

Thompson, D. R., Senk, S. L., Witonsky, D., Usiskin, Z., & Kaeley, G. (2006). *An evaluation of the second edition of UCSMP Algebra.* Chicago, IL: University of Chicago School Mathematics Project.

Table A2. Summary of *UCSMP Algebra* findings

Meets WWC group design standards with reservations

		Study findings	
Outcome domain	Sample size	Average improvement index *(percentile points)*	Statistically significant
General mathematics achievement	12 classrooms/189 students	+29	Yes
Algebra	12 classrooms/189 students	+20	Yes

Setting

The three high schools (grades 9–12) included in the analytic sample were located on the West Coast, in the Northeast, and in the South. School X was a large, ethnically diverse high school on the West Coast, serving approximately 2,800 students from inner-city and suburban environments; *UCSMP Geometry* had previously been used at the school. School Y was a suburban high school in the Northeast, serving 950 students from a middle- to upper-middle-class socioeconomic population; no *UCSMP* curricula were previously used at this school. School Z was a suburban high school of approximately 2,800 in a middle- to upper-middle-class neighborhood in the South and serves a large Hispanic community; no *UCSMP* curricula were previously used at this school.

Study sample

Thirteen schools were recruited for the study by advertising in *UCSMP* and NCTM publications. To participate, a school needed to have at least two teachers willing to participate, have four sections of algebra (in either middle or high school), and promise to keep classes intact for a full year. The study utilized a matched-pairs design, in which classes were matched within schools on students' math ability. When possible, classrooms were randomly assigned to intervention or comparison conditions within each pair; however, local conditions did not always permit random assignment.

This intervention report focuses on three high schools: X, Y, and Z (as labeled by the authors) that compared *UCSMP Algebra* (second edition) to other curricula. The analysis sample size included 189 students (98 intervention and 91 comparison) across six matched pairs of classrooms. Twenty-eight students were in one matched pair of classrooms in School X (14 intervention and 14 comparison), 114 in three matched pairs of classrooms in School Y (65 intervention and 49 comparison), and 47 in two matched pairs of classrooms in School Z (19 intervention and 28 comparison).[6] About 160 students were in grade 9; the remaining students were enrolled in grades 10–12.

Intervention group

Intervention classes used *UCSMP Algebra* (second edition, field trial version) during the 1992–93 school year. *UCSMP Algebra* emphasizes lessons with real-world applications, use of technology (e.g., scientific calculators), spaced introduction of important algebra concepts, integration of non-algebraic mathematic topics (e.g., geometry, data organization, and probability), and the use of reading passages to explain concepts and provide important information.

Comparison group

The comparison classroom in School X used *Saxon Math Algebra I: An Incremental Development.* In School Y, classrooms used *Houghton Mifflin's Algebra: Structure and Method Book I*, and School Z classrooms used *Prentice Hall's Algebra I*.

Outcomes and measurement

Shortly before the end of the school year, the teachers administered several assessments, three of which are eligible for this review. Two of the eligible assessments are in the algebra domain: The High School Subjects Tests: Algebra and a developer-created test—the *UCSMP* Problem-Solving and Understanding Test. The third outcome measure is in the general mathematics achievement domain: the *UCSMP* Algebra Test.

In addition to these three eligible outcomes, the study reported results for individual test items and for subsets of items based on whether teachers reported having an opportunity to cover related content in their classrooms. No measures of reliability or internal consistency were provided for these subtest results; consequently, these subtests are not included in this report. The study also reported on survey responses about teacher and students' attitudes. The survey data are not in an eligible domain in the Secondary Mathematics topic area and therefore, are excluded from this report.

The pretest used to match students and establish baseline equivalence between the intervention and comparison groups was the Iowa Algebra Aptitude Test. For a more detailed description of these outcome measures, see Appendix B.

Support for implementation

Teachers received the *UCSMP* text in three sections: chapters 1–4 at the beginning of the school year, chapters 5–8 in November, and chapters 9–13 in early winter. They also were given lesson notes and answers to questions, by chapter, throughout the school year. Teachers met twice with developers to provide feedback, raises issues, and discuss instructional concerns. They did not receive direct in-service training.

Appendix A.3: Research details for Hirschhorn (1993)

Hirschhorn, D. B. (1993). A longitudinal study of students completing four years of UCSMP mathematics. *Journal for Research in Mathematics Education, 24*(2), 136–158.

Additional source:

Hirschhorn, D. B. (1991). *Implementation of the first four years of the University of Chicago School Mathematics Project secondary curriculum* (Unpublished doctoral dissertation). University of Chicago, IL.

Table A3. Summary of *multiple UCSMP courses* findings — **Meets WWC group design standards with reservations**

		Study findings	
Outcome domain	**Sample size**	**Average improvement index *(percentile points)***	**Statistically significant**
General mathematics achievement	2 sites/62 students	+23	Yes

Setting

The analytic sample included in this intervention report consisted of two unnamed sites in affluent suburban areas. Each site included one feeder school in which a subset of the seventh- and eighth-grade students received instruction using *UCSMP Transition Mathematics* and *UCSMP Algebra* and one high school in which a subset of students used *UCSMP Geometry* and *UCSMP Advanced Algebra* in ninth and tenth grade.

Study sample

Three sites (A, B, and C) were selected where both traditional curricula and *UCSMP* curricula were used by students for 4 years. Students in the intervention group used *UCSMP* for 4 years, starting with *UCSMP Transition Mathematics* in seventh grade and ending with *UCSMP Advanced Algebra*. No student in the comparison group attended any *UCSMP* courses.[7] The researcher matched students on the pretest retrospectively. Since the intervention began in seventh grade, students were matched on their sixth-grade performance on a standardized exam (in 1986). The process differed slightly by site. In site A, the only available data on sixth-grade academic performance were composite scores for mathematics, reading, and general logic; because baseline equivalence on mathematics achievement alone could not be established, this site is excluded from WWC analysis. In sites B and C, students were matched on sixth-grade mathematics and reading scores. Since some of the comparison students in sites B and C had not taken advanced algebra by the end of tenth grade, two comparison groups were formed. This report focuses on the age-based comparison sample, wherein the comparison group was based on all students who started seventh grade at the same time (and thus, were in tenth grade at the time of the posttest, in 1990).[8] Results from sites B and C were pooled for the purposes of this review because when sites were analyzed separately, all students in the intervention group in site B had the same teacher and class in at least one grade, creating a confounding factor.

The eligible sample for this intervention report included 62 students in site A (31 intervention and 31 comparison), 26 students in site B (13 intervention and 13 comparison), and 36 students in site C (18 intervention and 18 comparison).[9] Among the sample, 48% were male.

Intervention group

The intervention students used *UCSMP* for 4 consecutive years, starting in seventh grade and ending in tenth grade. Students used *UCSMP Transition Mathematics* in 1986–87, *UCSMP Algebra* in 1987–88, *UCSMP Geometry* in 1988–89, and *UCSMP Advanced Algebra* in 1989–90.

Comparison group

Students in the comparison group attended the same high schools and feeder schools as their peers in the intervention group. They used traditional mathematics curricula that corresponded to each of the *UCSMP* courses. The traditional curricula were published by Addison-Wesley, Merrill, Houghton Mifflin, and unnamed others.

Outcomes and measurement

The study included two outcomes in the general mathematics achievement domain measured when students were in the tenth grade, near the end of the academic year (April/May 1990). The outcomes were the Mathematics Level I Achievement Test (The College Board, 1988) and a developer-created mathematics achievement test. In addition to these two student achievement outcomes, the study included one ineligible outcome created using items from the Student Opinion Survey which measured students' attitudes towards mathematics.

For the pretest measure, the researchers administered the Stanford Achievement Test, Intermediate 2 Level - Form E and the Otis Lennon School Ability Test, Intermediate Level, Form R at one of the study sites (reading comprehension and total mathematics percentile scores), and the McGraw-Hill Comprehensive Test of Basic Skills, Form U, Level G (total reading and mathematics percentile scores) at the other study site. For a more detailed description of these outcome measures, see Appendix B.

Support for implementation

The report did not describe teacher training or implementation support. However, at site B, some of the seventh- and eighth-grade teachers were involved with the *UCSMP* pilot effort, which meant they had previous experience implementing *UCSMP* curricula.

Appendix B: Outcome measures for each domain

General mathematics achievement	
Mathematics Level 1 Achievement Test, Form 3JAC2	The Mathematics Level 1 Achievement Test, Form 3JAC2 is a standardized test of mathematics achievement (The College Board, 1988) which covers geometry and second year algebra content. The test includes 50 multiple-choice questions. The test was scored according to College Board specifications and yielded scores ranging from 200 to 800 points. No calculators were allowed during the test. The reported reliability alpha statistics ranged from .60 to .93, with a median of .87 (as cited in Hirschhorn, 1993).
UCSMP Algebra and Probability Test	The *UCSMP* Algebra and Probability test is a 40-item multiple choice test developed by the *UCSMP*. The topics it covers include: translating expressions from verbal to symbolic, linear relationships in two variables, quadratics, geometric relationships, statistics and probability, percentage applications, graph interpretation, exponential relationships, and other miscellaneous topics. Students were allowed to use calculators during the test. Although this assessment was designed by the developer of the curriculum used in the intervention condition, it focuses on content that is typically taught in algebra classrooms, so these assessments are not considered overaligned with the intervention. Because the content of the assessment includes algebra, geometry, and statistics and probability, the test falls within the general mathematics achievement domain per the Secondary Mathematics review protocol (version 3.1). The reported Kuder-Richardson reliability estimate ranged between .81 and .83 (as cited in Thompson et al., 2006).
UCSMP Applications Test	The *UCSMP* Applications Test is a 30-question, multiple-choice test that was developed for this study, as well as for use by future researchers and school personnel. It covered the topics of arithmetic, algebra, geometry, and advanced algebra. Scientific calculators were provided to students who did not have them, and their use was encouraged. Items were selected from the Second International Mathematics Study (Chang & Ruzicka, 1985), the Formative Study of *UCSMP Advanced Algebra* (Hedges et al., 1988), a submittal to the College Board by personal letter in 1988, and original items. Reported sample reliability alpha statistics ranged from .64 to .84, with a median of .74 (as cited in Hirschhorn, 1993).
Algebra	
Orleans-Hanna Algebra Prognosis Test	The 60-item nationally normed Orleans-Hanna Algebra Prognosis Test is used to place and group students in algebra courses and inform the development of lessons plans. It was developed in 1928 and revised in 1980. This measure was administered as a pretest in August 1991 and as a posttest in May 1992. For the pretest measure, the author reports both a standardized score and a raw score. Only the standardized score is used in this review because, per the author, the standardized score allows comparability between the pretest and posttest. The reported sample Kuder-Richardson reliability estimate was .96 (as cited in Peters, 1992).
High School Subject Tests: Algebra	The High School Subject Tests: Algebra is a 40-item multiple-choice standardized test developed by American Testronics. It includes items on polynomials, linear equations/inequalities, evaluating expressions, linear relationships in two variables, quadratics, radicals, properties of numbers, linear systems, rational expressions, factoring, literal equations, and proportions. The use of calculators was not permitted during the test. The test developer-reported Kuder-Richardson reliability estimate was .86, and for the sample it was reported as being approximately .80 (as cited in Thompson et al., 2006).
UCSMP Problem-Solving and Understanding Test	The *UCSMP* Problem-Solving and Understanding Test is an open-ended problem-solving test developed by *UCSMP*. In the study, it was administered in two forms, with half the students in each class randomly assigned to the even form of the test and the other half assigned to the odd form. Each form contains four open-ended items. The results from the two forms were pooled by the WWC. Five of the eight items were scored on a scale of zero to four, and three items on a scale of zero to two. Each item was scored independently and blindly by two raters guided by rubrics developed for each item, and when they disagreed, a third rater scored the items, and the median score was used. Inter-rater reliability estimates (not identified) ranged from .74 to .95 for items on both forms. Although this assessment was designed by the developer of the curriculum used in the intervention condition, it focuses on content that is typically taught in algebra classrooms, so these assessments are not overaligned with the intervention (as cited in Thompson et al., 2006).

Appendix C.1: Findings included in the rating for studies of *UCSMP Algebra* for the general mathematics achievement domain

			Mean (standard deviation)		WWC calculations			
Outcome measure	**Study sample**	**Sample size**	**Intervention group**	**Comparison group**	**Mean difference**	**Effect size**	**Improvement index**	***p*-value**
Thompson et al. (2006)[a]								
UCSMP Algebra Test	Grades 9–12, Schools X, Y, & Z	12 classes/ 189 students	49.8 (16.3)	37.3 (14.9)	12.54	0.81	+29	.04
Domain average for general mathematics achievement (Thompson et al., 2006)						**0.81**	**+29**	**Statistically significant**
Domain average for general mathematics achievement across all studies						**0.81**	**+29**	**na**

Table Notes: For mean difference, effect size, and improvement index values reported in the table, a positive number favors the intervention group and a negative number favors the comparison group. The effect size is a standardized measure of the effect of an intervention on outcomes, representing the average change expected for all individuals who are given the intervention (measured in standard deviations of the outcome measure). The improvement index is an alternate presentation of the effect size, reflecting the change in an average individual's percentile rank that can be expected if the individual is given the intervention. The WWC-computed average effect size is a simple average rounded to two decimal places; the average improvement index is calculated from the average effect size. The statistical significance of the study's domain average was determined by the WWC. Some statistics may not sum as expected due to rounding. na = not applicable.

[a] For Thompson et al. (2006), the WWC did not need to make corrections for clustering or multiple comparisons. The *p*-value presented here was reported in the original study. The WWC calculated the intervention group mean using a difference-in-differences approach by adding the impact of the program (i.e., difference in mean gains between the intervention and comparison groups) to the unadjusted comparison group posttest means. Please see the WWC Procedures and Standards Handbook (version 3.0) for more information. The findings reported for the *UCSMP* Algebra Test in the earlier version of this report were adjusted for multiple comparisons because all three of the outcomes from the Thompson et al. (2006) study were included in the only outcome domain in the topic area: general mathematics achievement. This report includes multiple outcome domains. As a result, there is only one outcome in the general mathematics achievement outcome domain (the other outcomes are in the algebra outcome domain). Because there is only one outcome in the general mathematics achievement domain, a multiple comparison correction was not required. The WWC calculations reported in this table differ slightly from those reported in the earlier version of this report. The slight difference results from analyses using a difference-in-differences approach, which was not used in the prior version. This study is characterized as having a statistically significant positive effect because the estimated effect is positive and statistically significant. For more information, please refer to the WWC Procedures and Standards Handbook (version 3.0), p. 26.

Appendix C.2: Findings included in the rating for studies of *UCSMP Algebra* for the algebra domain

			Mean (standard deviation)		WWC calculations			
Outcome measure	**Study sample**	**Sample size**	**Intervention group**	**Comparison group**	**Mean difference**	**Effect size**	**Improvement index**	***p*-value**
Thompson et al. (2006)[a]								
High School Subject Tests: Algebra	Mostly grade 9, Schools X, Y, & Z	12 classes/ 189 students	48.24 (16.30)	46.00 (14.90)	2.24	0.15	+6	.83
UCSMP Problem-Solving and Understanding Test	Mostly grade 9, Schools X, Y, & Z	12 classes/ 189 students	6.57 (3.69)	3.39 (2.54)	3.18	0.92	+32	< .02
Domain average for algebra (Thompson et al., 2006)						**0.53**	**+20**	**Statistically significant**
Peters (1992)[b]								
Orleans-Hanna Algebra Prognosis Test	Grade 8 (math talented)	2 classes/ 36 students	95.02 (4.09)	95.63 (4.53)	–0.61	–0.14	–6	> .05
Domain average for algebra (Peters, 1992)						**–0.14**	**–6**	**Not statistically significant**
Domain average for algebra across all studies						**0.20**	**+7**	**na**

Table Notes: For mean difference, effect size, and improvement index values reported in the table, a positive number favors the intervention group and a negative number favors the comparison group. The effect size is a standardized measure of the effect of an intervention on outcomes, representing the average change expected for all individuals who are given the intervention (measured in standard deviations of the outcome measure). The improvement index is an alternate presentation of the effect size, reflecting the change in an average individual's percentile rank that can be expected if the individual is given the intervention. The WWC-computed average effect size is a simple average rounded to two decimal places; the average improvement index is calculated from the average effect size. The statistical significance of each study's domain average was determined by the WWC. Some statistics may not sum as expected due to rounding. na = not applicable.

[a] For Thompson et al. (2006), corrections for clustering and multiple comparisons were needed but did not affect whether any of the contrasts were found to be statistically significant. The WWC calculated the intervention group mean using a difference-in-differences approach by adding the impact of the program (i.e., difference in mean gains between the intervention and comparison groups) to the unadjusted comparison group posttest means. Please see the WWC Procedures and Standards Handbook (version 3.0) for more information. The study-reported results for the *UCSMP* Problem-Solving and Understanding Test odd and even forms separately. The two *p*-values associated with the forms are < .01 and .02, respectively. The WWC pooled the results across the two forms. The WWC calculations reported in this table differ slightly from those reported in the earlier version of this report. The slight difference results from analyses using a difference-in-differences approach, which was not used in the earlier version. This study is characterized as having a statistically significant positive effect because the effect for at least one measure within the domain is positive and statistically significant, and no effects are negative and statistically significant (correcting for clustering). For more information, please refer to the WWC Procedures and Standards Handbook (version 3.0), p. 26.

[b] For Peters (1992), the WWC did not need to make corrections for clustering, multiple comparisons, or to adjust for baseline differences. The *p*-value presented here was reported in the original study. The WWC calculated the intervention group mean using a difference-in-differences approach by adding the impact of the program (i.e., difference in mean gains between the intervention and comparison groups) to the unadjusted comparison group posttest means. Please see the WWC Procedures and Standards Handbook (version 3.0) for more information. This study is characterized as having an indeterminate effect because the estimated effect is neither statistically significant nor substantively important. For more information, please refer to the WWC Standards and Procedures Handbook (version 3.0), p. 26.

Appendix C.3: Findings included in the rating for *multiple UCSMP courses* for the general mathematics achievement domain

			Mean (standard deviation)		WWC calculations			
Outcome measure	**Study sample**	**Sample size**	**Intervention group**	**Comparison group**	**Mean difference**	**Effect size**	**Improvement index**	***p*-value**
Hirschhorn (1993)[a]								
Mathematics Level 1 Achievement Test	Grade 10, sites B & C	2 sites/ 62 students	492.36 (46.39)	489.03 (78.71)	3.32	0.06	+2	Site B: < .05 Site C: > .05
UCSMP Applications Test	Grade 10, sites B & C	2 sites/ 62 students	21.19 (3.88)	16.46 (3.95)	4.74	1.18	+38	Site B: < .01 Site C: < .05
Domain average for general mathematics achievement (Hirschhorn, 1993)						**0.62**	**+23**	**Statistically significant**
Domain average for general mathematics achievement across all studies						**0.62**	**+23**	**na**

Table Notes: For mean difference, effect size, and improvement index values reported in the table, a positive number favors the intervention group and a negative number favors the comparison group. The effect size is a standardized measure of the effect of an intervention on outcomes, representing the average change expected for all individuals who are given the intervention (measured in standard deviations of the outcome measure). The improvement index is an alternate presentation of the effect size, reflecting the change in an average individual's percentile rank that can be expected if the individual is given the intervention. The WWC-computed average effect size is a simple average rounded to two decimal places; the average improvement index is calculated from the average effect size. The statistical significance of the study's domain average was determined by the WWC. Some statistics may not sum as expected due to rounding. na = not applicable.

[a] For Hirschhorn (1993), the author presented *p*-values as well as unadjusted posttest means and standard deviations by site. The results for the Mathematics Level 1 Achievement Test were positive and statistically significant in site B (< .05) and not statistically significant or substantively important in site C (> .05). The results for the *UCSMP* Applications Test were positive and statistically significant at each site (< .01 in site B and < .05 in site C). The WWC combined the results for sites B and C and calculated the intervention group mean using a difference-in-differences approach by adding the impact of the program (i.e., difference in mean gains between the intervention and comparison groups) to the unadjusted comparison group posttest means. After adjusting for multiple comparisons, the WWC-calculated results were neither statistically significant nor substantively important for the Mathematics Level 1 Achievement Test (.81) and positive and statistically significant for the *UCSMP* Applications Test (< .01). Please see the WWC Procedures and Standards Handbook (version 3.0) for more information. The study was reviewed as evidence of *multiple UCSMP courses*, following the procedure set in the Secondary Mathematics review protocol (version 3.1). This approach differs from the approach used when this study was previously reviewed under the High School Mathematics review protocol (version 2.0). The WWC calculations reported in this table differ slightly from those reported in the earlier version of this report. The difference results from analyses using a difference-in-differences approach, which was not used in the earlier version. This study is characterized as having a statistically significant positive effect because the effect for at least one measure within the domain is positive and statistically significant, and no effects are negative and statistically significant, accounting for multiple comparisons. For more information, please refer to the WWC Procedures and Standards Handbook (version 3.0), p. 26.

Endnotes

* Due to the 2015 restructuring of the Mathematics topic area from three areas (Elementary, Middle, and High School) to two areas (Primary and Secondary Mathematics), this report is considered a new report rather than an updated report. The information in this report combines the research examined in the prior reports and presents the conclusions differently.

[1] The descriptive information for this program was obtained from publicly available sources, such as the publisher website (http://ucsmp.uchicago.edu/secondary/overview/). The WWC requests developers review the program description sections for accuracy from their perspective. The program description was provided to the developer in November 2014; however, the WWC received no response. Further verification of the accuracy of the descriptive information for this program is beyond the scope of this review.

[2] The WWC previously released two reports for *UCSMP*: *University of Chicago School Mathematics Project Algebra* was reviewed under the Middle School Mathematics review protocol and released in March 2009, and *University of Chicago School Mathematics Project 6–12 Curriculum* was reviewed under the High School Mathematics review protocol and released in July 2011. The literature search reflects documents publicly available by November 2015. This report has been updated to include reviews of 23 studies that were not included in the prior reports. Of the additional studies, 23 were not within the scope of the review protocol for the Secondary Mathematics topic area. A complete list and disposition of all studies reviewed are provided in the references. The studies in this report were reviewed using the Standards from the WWC Procedures and Standards Handbook (version 3.0), along with those described in the Secondary Mathematics topic area review protocol (version 3.1). The evidence presented in this report is based on available research. Findings and conclusions may change as new research becomes available.

[3] For criteria used in the determination of the rating of effectiveness and extent of evidence, see the WWC Rating Criteria on p. 24. These improvement index numbers show the average and range of individual-level improvement indices for all findings across the studies.

[4] No studies examining the effectiveness of *UCSMP Geometry; UCSMP Advanced Algebra; UCSMP Functions, Statistics, and Trigonometry;* and *UCSMP Precalculus and Discrete Mathematics* fall within the scope of the Secondary Mathematics review protocol and meet WWC group design standards. Because no studies meet WWC group design standards at this time, the WWC is unable to draw any conclusions based on research about the effectiveness or ineffectiveness of *UCSMP Geometry; UCSMP Advanced Algebra; UCSMP Functions, Statistics, and Trigonometry;* and *UCSMP Precalculus and Discrete Mathematics* on secondary students. Additional research that meets WWC standards is needed to determine the effectiveness or ineffectiveness of these courses.

[5] The study authors also examined a second comparison group that used *UCSMP Algebra* first edition; the comparison included 334 students. The comparison was not eligible for review based on the Secondary Mathematics topic area review protocol and is excluded from this intervention report.

[6] The study authors also examined a second comparison group that used *UCSMP Algebra* first edition; the comparison included 334 students. The comparison was not eligible for review based on the Secondary Mathematics topic area review protocol and is excluded from this intervention report.

[7] *UCSMP Transition Mathematics* falls within the Primary Mathematics topic area. Because students also used three Secondary Mathematics courses (*UCSMP Algebra, UCSMP Geometry,* and *UCSMP Advanced Algebra*) and the student outcomes were measured after *UCSMP Advanced Algebra*, this study is being reviewed by the Secondary Mathematics topic area.

[8] The second course-based comparison group consisted of students at the end of *UCSMP Advanced Algebra*. Since this involved comparing tenth-grade intervention students with eleventh-grade comparison students, we did not include this comparison in the intervention report.

[9] The WWC excluded the 22 students in site A (11 intervention and 11 comparison). In site A, the only available data on sixth-grade academic performance were composite scores for math, reading, and general logic; because baseline equivalence on math achievement alone could not be established, this site is excluded from WWC analysis.

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WWC Rating Criteria

Criteria used to determine the rating of a study

Study rating	Criteria
Meets WWC group design standards without reservations	A study that provides strong evidence for an intervention's effectiveness, such as a well-implemented RCT.
Meets WWC group design standards with reservations	A study that provides weaker evidence for an intervention's effectiveness, such as a QED or an RCT with high attrition that has established equivalence of the analytic samples.

Criteria used to determine the rating of effectiveness for an intervention

Rating of effectiveness	Criteria
Positive effects	Two or more studies show statistically significant positive effects, at least one of which met WWC group design standards for a strong design, AND No studies show statistically significant or substantively important negative effects.
Potentially positive effects	At least one study shows a statistically significant or substantively important positive effect, AND No studies show a statistically significant or substantively important negative effect AND fewer or the same number of studies show indeterminate effects than show statistically significant or substantively important positive effects.
Mixed effects	At least one study shows a statistically significant or substantively important positive effect AND at least one study shows 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, OR At least one study shows a statistically significant or substantively important effect AND more studies show an indeterminate effect than show a statistically significant or substantively important effect.
Potentially negative effects	One study shows a statistically significant or substantively important negative effect and no studies show a statistically significant or substantively important positive effect, OR Two or more studies show statistically significant or substantively important negative effects, at least one study shows a statistically significant or substantively important positive effect, and more studies show statistically significant or substantively important negative effects than show statistically significant or substantively important positive effects.
Negative effects	Two or more studies show statistically significant negative effects, at least one of which met WWC group design standards for a strong design, AND No studies show statistically significant or substantively important positive effects.
No discernible effects	None of the studies shows a statistically significant or substantively important effect, either positive or negative.

Criteria used to determine the extent of evidence for an intervention

Extent of evidence	Criteria
Medium to large	The domain includes more than one study, AND The domain includes more than one school, AND The domain findings are based on a total sample size of at least 350 students, OR, assuming 25 students in a class, a total of at least 14 classrooms across studies.
Small	The domain includes only one study, OR The domain includes only one school, OR The domain findings are based on a total sample size of fewer than 350 students, AND, assuming 25 students in a class, a total of fewer than 14 classrooms across studies.

Glossary of Terms

Attrition Attrition occurs when an outcome variable is not available for all participants initially assigned to the intervention and comparison groups. The WWC considers the total attrition rate and the difference in attrition rates across groups within a study.

Clustering adjustment If intervention assignment is made at a cluster level and the analysis is conducted at the student level, the WWC will adjust the statistical significance to account for this mismatch, if necessary.

Confounding factor A confounding factor is a component of a study that is completely aligned with one of the study conditions, making it impossible to separate how much of the observed effect was due to the intervention and how much was due to the factor.

Design The design of a study is the method by which intervention and comparison groups were assigned.

Domain A domain is a group of closely related outcomes.

Effect size The effect size is a measure of the magnitude of an effect. The WWC uses a standardized measure to facilitate comparisons across studies and outcomes.

Eligibility A study is eligible for review and inclusion in this report if it falls within the scope of the review protocol and uses either an experimental or matched comparison group design.

Equivalence A demonstration that the analysis sample groups are similar on observed characteristics defined in the review area protocol.

Extent of evidence An indication of how much evidence supports the findings. The criteria for the extent of evidence levels are given in the WWC Rating Criteria on p. 24.

Improvement index Along a percentile distribution of individuals, the improvement index represents the gain or loss of the average individual due to the intervention. As the average individual starts at the 50th percentile, the measure ranges from –50 to +50.

Intervention An educational program, product, practice, or policy aimed at improving student outcomes.

Intervention report A summary of the findings of the highest-quality research on a given program, product, practice, or policy in education. The WWC searches for all research studies on an intervention, reviews each against design standards, and summarizes the findings of those that meet WWC design standards.

Multiple comparison adjustment When a study includes multiple outcomes or comparison groups, the WWC will adjust the statistical significance to account for the multiple comparisons, if necessary.

Quasi-experimental design (QED) A quasi-experimental design (QED) is a research design in which study participants are assigned to intervention and comparison groups through a process that is not random.

Randomized controlled trial (RCT) A randomized controlled trial (RCT) is an experiment in which eligible study participants are randomly assigned to intervention and comparison groups.

Rating of effectiveness The WWC rates the effects of an intervention in each domain based on the quality of the research design and the magnitude, statistical significance, and consistency in findings. The criteria for the ratings of effectiveness are given in the WWC Rating Criteria on p. 24.

Single-case design A research approach in which an outcome variable is measured repeatedly within and across different conditions that are defined by the presence or absence of an intervention.

Glossary of Terms

Standard deviation The standard deviation of a measure shows how much variation exists across observations in the sample. A low standard deviation indicates that the observations in the sample tend to be very close to the mean; a high standard deviation indicates that the observations in the sample tend to be spread out over a large range of values.

Statistical significance Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups. The WWC labels a finding statistically significant if the likelihood that the difference is due to chance is less than 5% ($p < .05$).

Substantively important A substantively important finding is one that has an effect size of 0.25 or greater, regardless of statistical significance.

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

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

Intervention Report
Practice Guide
Quick Review
Single Study Review

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

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