What Works Clearinghouse

INSTITUTE OF EDUCATION SCIENCES

Core-Plus Mathematics

Program Description[1]

Core-Plus Mathematics is a four-year curriculum that replaces the traditional sequence with courses that each feature interwoven strands of algebra and functions, statistics and probability, geometry and trigonometry, and discrete mathematics. The first three courses in the series provide a common core of broadly useful mathematics, while the fourth continues the preparation of students for college mathematics and statistics courses. The curriculum emphasizes mathematical modeling, using technology to emphasize reasoning with multiple representations (verbal, numerical, graphical, and symbolic) and to focus on goals in which mathematical thinking and problem solving are central. Instructional materials promote active learning and teaching centered around collaborative small-group investigations of problem situations, followed by teacher-led whole-class summarizing activities that lead to analysis, abstraction, and further application of underlying mathematical ideas.

Research[2]

One study of *Core-Plus Mathematics* that falls within the scope of the High School Mathematics review protocol meets What Works Clearinghouse (WWC) evidence standards with reservations. The one study included 1,050 high school students in 11 schools in multiple states.[3]

Based on the one study, the WWC considers the extent of evidence for *Core-Plus Mathematics* on high school students to be small for math achievement.

1. The descriptive information for this program was obtained from publicly available sources: the program's website (http://www.wmich.edu/cpmp, downloaded June 2010) and Schoen and Hirsch (2002). The WWC requests developers to review the program description sections for accuracy from their perspective. Further verification of the accuracy of the descriptive information for this program is beyond the scope of this review. The literature search reflects documents publicly available by March 2010.
2. The studies in this report were reviewed using WWC Evidence Standards, Version 2.0 (see the WWC Procedures and Standards Handbook, Chapter III), as described in protocol Version 2.0.
3. The evidence presented in this report is based on available research. Findings and conclusions may change as new research becomes available.

Effectiveness

Core-Plus Mathematics was found to have potentially positive effects on mathematics achievement for high school students.

	Mathematics achievement
Rating of effectiveness	Potentially positive effects
Improvement index[4]	Average: +15 percentile points Range: –15 to +36 percentile points

Additional program information

Developer and contact

Developed by the Core-Plus Mathematics Project (CPMP) at Western Michigan University, *Core-Plus Mathematics* is distributed by Glencoe/McGraw-Hill. Email: cpmp@wmich.edu. Web: http://www.wmich.edu/cpmp. Telephone: (866) 407-2767.

Scope of use

This review is restricted to the first edition of *Core-Plus Mathematics*, published under the title *Contemporary Mathematics in Context*, with copyright dates of 2003 and earlier. Courses in the first edition were field tested beginning in 1994. The second edition of *Core-Plus Mathematics* has copyright dates of 2008 and later.

Teaching

Core-Plus Mathematics units are designed around multi-day lessons organized around cycles of instructional activities intended primarily for small-group work in the classroom and for individual work outside of the classroom. Lessons begin with a full-class discussion of a problem situation and related questions to think about in which the teacher is director and moderator. Classroom activity then shifts to investigating focused problems and questions related to the launching situation by gathering data, looking for patterns, constructing models and meanings, and making and verifying conjectures, with the teacher acting as facilitator. A full-class discussion (referred to as a Checkpoint) of concepts and methods developed by different small groups then provides an opportunity to share progress and thinking, with the teacher acting as moderator. Finally, students are given a task related to lesson objectives to complete on their own, while the teacher serves as an intellectual coach. In addition to the classroom investigations, *Core-Plus Mathematics* provides sets of MORE tasks, which are designed to engage students in Modeling with, Organizing, Reflecting on, and Extending their mathematical understanding in individual work outside of class.

Cost

According to the publisher's website (http://www.mhprofessional.com), the student edition of the textbook for each course costs approximately $88.

Research

Seventeen studies reviewed by the WWC investigated the effects of *Core-Plus Mathematics* on high school students. One study is a quasi-experimental design that meets WWC evidence standards with reservations. The remaining 16 studies do not meet either WWC evidence standards or eligibility screens.

Meets evidence standards with reservations

Schoen and Hirsch (2002) conducted a quasi-experiment using a student matched-pairs design in 11 high schools that volunteered to administer pretests and posttests to students in *Core-Plus Mathematics* and traditional classrooms. The 11 schools were drawn from a larger group of 36 schools that were field testing the *Core-Plus*

4. These numbers show the average and range of student-level improvement indices for all findings across the study.

Research *(continued)*

Mathematics curriculum. Students in comparison classrooms were grouped by their most recently completed math course, and then matched to students in the intervention group using pretest score, school, and gender, in that order. This process was conducted separately during each of the two years of the study, though only five of the 11 schools from year one agreed to posttest students in the comparison group in year two. The main analysis included 1,050 students (525 intervention and 525 comparison) in year one and 390 students (195 intervention and 195 control) in year two. Additional analyses varied in sample size, with baseline equivalence information presented separately for each of these samples.

Extent of evidence

The WWC categorizes the extent of evidence in each domain as small or medium to large (see the WWC Procedures and Standards Handbook, Appendix G). The extent of evidence takes into account the number of studies and the total sample size across the studies that meet WWC evidence standards with or without reservations.[5]

The WWC considers the extent of evidence for *Core-Plus Mathematics* to be small for mathematics achievement for high school students.

Effectiveness

Findings

The WWC review of interventions for High School Mathematics addresses student outcomes in one domain: mathematics achievement. The findings below present the authors' estimates and WWC-calculated estimates of the size and the statistical significance of the effects of *Core-Plus Mathematics* on high school students.[6]

Mathematics achievement. Schoen and Hirsch (2002) reported positive and statistically significant effects of *Core-Plus Mathematics* on the Iowa Tests of Educational Development mathematics subtest in ninth grade, all three subtests of the Course 1 CPMP Posttest in ninth grade, and contextual algebra and coordinate geometry subtests of the Course 2 CPMP Posttest in tenth grade; these were confirmed by the WWC after adjustments were made for clustering and multiple comparisons. The study also reported a positive, though not statistically significant, effect on SAT math scores; this finding was large enough to be considered substantively important according to WWC criteria (i.e., an effect size of at least 0.25). As the finding for at least one measure within the domain is positive and statistically significant, and no effects are negative and statistically significant, accounting for clustering and multiple comparisons, this study is characterized by the WWC as having a statistically significant positive effect.

Rating of effectiveness

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

5. The extent of evidence categorization was developed to tell readers how much evidence was used to determine the intervention rating, focusing on the number and size of studies. Additional factors associated with a related concept—external validity, such as the students' demographics and the types of settings in which studies took place—are not taken into account for the categorization. Information about how the extent of evidence rating was determined for *Core-Plus Mathematics* is in Appendix A6.
6. The level of statistical significance was reported by the study authors or, when necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For the formulas the WWC used to calculate the statistical significance, see WWC Procedures and Standards Handbook, Appendix C for clustering and WWC Procedures and Standards Handbook, Appendix D for multiple comparisons. In the case of Schoen and Hirsch (2002), corrections for clustering and multiple comparisons were needed, so the significance levels may differ from those reported in the original study.

The WWC found *Core-Plus Mathematics* to have potentially positive effects on mathematics achievement for high school students

Improvement index

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

The average improvement index for mathematics achievement is +15 percentile points in the one study, with a range of –15 to +36 percentile points across findings.

Summary

The WWC reviewed 17 studies on *Core-Plus Mathematics* for high school students. One of these studies meets WWC evidence standards with reservations; the remaining 16 studies do not meet either WWC evidence standards or eligibility screens. Based on the one study, the WWC found potentially positive effects on mathematics achievement for high school students. The conclusions presented in this report may change as new research emerges.

References

Meets WWC evidence standards with reservations

Schoen, H. L., & Hirsch, C. R. (2002). The *Core-Plus Mathematics* project: Perspectives and student achievement. In S. Senk & D. Thompson (Eds.), *Standards-based school mathematics curricula: What are they? What do students learn?* (pp. 311–343). Hillsdale, NJ: Lawrence Erlbaum Associates.

Additional source:

Schoen, H. L., Hirsch, C. R., & Ziebarth, S. W. (1998). *An emerging profile of the mathematical achievement of students in the* Core-Plus Mathematics *project*. Paper presented at the Annual Meeting of the American Educational Research Association, San Diego, CA.

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

Fey, J., & Hirsch, C. (2007). The case of *Core-Plus Mathematics*. In C. Hirsch (Ed.), *Perspectives on the design and development of school mathematics curricula*. Reston, VA: National Council of Teachers of Mathematics. The study is ineligible for review because it does not examine the effectiveness of an intervention.

Fey, J., Hirsch, C., & Schoen, H. (2007). The future of high school mathematics: New priorities and promising innovations. *Michigan Section MAA Newsletter, 34*, 10–14. The study is ineligible for review because it does not examine the effectiveness of an intervention.

Fey, J. T., Hirsch, C. R., Hart, E., Schoen, H., & Watkins, A. (2007). Editor's endnotes. *American Mathematical Monthly, 114*(7), 654–656. The study is ineligible for review because it does not examine the effectiveness of an intervention.

Hirsch, C. R., & Schoen, H. (2002). *Developing mathematical literacy: A* Core-Plus Mathematics *project longitudinal study progress report.* Unpublished manuscript. The study does not meet WWC evidence standards because it uses a quasi-experimental design in which the analytic intervention and comparison groups are not shown to be equivalent.

Huntley, M. A. (2000). Effects of standards-based mathematics education: A study of the *Core-Plus Mathematics* project algebra and functions strand. *Journal for Research in Mathematics Education, 31*(3), 328. The study does not meet WWC evidence standards because it uses a quasi-experimental

References *(continued)*

design in which the analytic intervention and comparison groups are not shown to be equivalent.

Latterell, C. M. (2003). Testing the problem-solving skills of students in an NCTM-oriented curriculum. *The Mathematics Educator, 13*(1), 5–14. The study is ineligible for review because it does not examine the effectiveness of an intervention.

Mariano, T. (n.d.). *A randomized control group study of student achievement on the New York State Mathematics A Regents High School examination*. Retrieved from http://www.wmich.edu/cpmp/pdfs/CPMP_Achievement_Ithaca.pdf. The study is ineligible for review because it does not provide enough information about its design to assess whether it meets standards.

Nelson, R. (2005). *A matched study of Washington state 10th grade assessment scores of students in schools using the* Core-Plus Mathematics *program*. Retrieved from http://www.wmich.edu/cpmp/pdfs/CPMP_Achievement_WA_22Schools.pdf. The study does not meet WWC evidence standards because it uses a quasi-experimental design in which the analytic intervention and comparison groups are not shown to be equivalent.

Schoen, H., Ziebarth, S., Hirsch, C., & Lorenz, A. B. (2010). *A five-year study of the first edition of the* Core-Plus Mathematics *curriculum*. Charlotte, NC: Information Age Publishing. The study does not meet WWC evidence standards because it uses a quasi-experimental design in which the analytic intervention and comparison groups are not shown to be equivalent.

Schoen, H. L., Cebulla, K. J., & Winsor, M. S. (2001). *Preparation of students in a standards-oriented mathematics curriculum for college entrance tests, placement tests, and beginning mathematics courses*. Paper presented at the annual meeting of the American Educational Research Association, Seattle, WA. The study does not meet WWC evidence standards because it uses a quasi-experimental design in which the analytic intervention and comparison groups are not shown to be equivalent.

Schoen, H. L., & Hirsch, C. R. (2003). Responding to calls for change in high school mathematics: Implication for collegiate mathematics. *American Mathematical Monthly, 110*(2), 109–123. The study does not meet WWC evidence standards because it uses a quasi-experimental design in which the analytic intervention and comparison groups are not shown to be equivalent.

Stucki, J. (2006). *Wayzata High School, Plymouth, MN Mathematics program evaluation*. Retrieved from http://www.wmich.edu/cpmp/pdfs/CPMP_Achievement_Wayzata.pdf. The study does not meet WWC evidence standards because it uses a quasi-experimental design in which the analytic intervention and comparison groups are not shown to be equivalent.

Tauer, S. (n.d.). *How does the use of two different mathematics curricula affect student achievement? A comparison study in Derby, Kansas*. Retrieved from http://www.wmich.edu/cpmp/pdfs/CPMP_Achievement_Derby.pdf. The study does not meet WWC evidence standards because it uses a quasi-experimental design in which the analytic intervention and comparison groups are not shown to be equivalent.

Verkaik, M. (2007). *CPMP student performance at Holland Christian High School*. Retrieved from http://www.wmich.edu/cpmp/pdfs/CPMP_Achievement_Holland.pdf. The study is ineligible for review because it does not use a comparison group design or a single-case design.

Walker, R. K. (1999). *Students' conceptions of mathematics and the transition from a standards-based reform curriculum to college mathematics*. Unpublished doctoral dissertation, Western Michigan University, Kalamazoo. The study is ineligible for review because it does not include an outcome within a domain specified in the protocol.

Zahrt, L. T. (2001). *School reform math programs: An evaluation for leaders*. Unpublished doctoral dissertation, Eastern Michigan University, Ypsilanti. The study does not meet evidence standards because it uses a quasi-experimental design in which the analytic intervention and comparison groups are not shown to be equivalent.

Appendix

Appendix A1 Study characteristics: Schoen & Hirsch, 2002

Characteristic	Description
Study citation	Schoen, H. L., & Hirsch, C. R. (2002). The *Core-Plus Mathematics* project: Perspectives and student achievement. In S. Senk & D. Thompson (Eds.), *Standards-based school mathematics curricula: What are they? What do students learn?* (pp. 311–343). Hillsdale, NJ: Lawrence Erlbaum Associates. ***Additional source:*** Schoen, H. L., Hirsch, C. R., & Ziebarth, S. W. (1998). *An emerging profile of the mathematical achievement of students in the* Core-Plus Mathematics *project*. Paper presented at the Annual Meeting of the American Educational Research Association, San Diego, CA.
Participants	Among an initial sample of 36 high schools that were field testing the *Core-Plus Mathematics* curriculum, 11 schools volunteered to administer pretests and posttests to students in both *Core-Plus Mathematics* and traditional classrooms. The authors state that schools were encouraged to create heterogeneous classroom groupings, although this was not always possible. The authors utilized a stratified matched-pairs design to select the intervention and comparison samples. Students in comparison classrooms were grouped by their most recently completed math course, and then matched to students in the intervention group using pretest scores, school, and gender, in that order. This process was conducted separately during each of the two years of the study (only five of the 11 schools from year one agreed to posttest students in the comparison group in year two). The main analysis included 1,050 students (525 intervention and 525 comparison) in year one and 390 students (195 intervention and 195 control) in year two. Additional analyses (reported in Appendices A3 and A4) varied in sample size, with baseline equivalence information presented separately for each of these samples.
Setting	The full set of 36 field-test schools were located in Alaska, California, Colorado, Georgia, Idaho, Iowa, Kentucky, Michigan, Ohio, South Carolina, and Texas. The 11 schools in the year one analysis included six from the Midwest (one urban, one rural, and four suburban), three from the West (one urban and two rural), one urban school from the East, and one rural school from the South. At each site, there were from two to five *Core-Plus Mathematics* teachers and from one to three comparison teachers. Five of the 11 schools continued into the year two analysis: two suburban, Midwestern schools and three urban schools, one from the South and two from the West.
Intervention	The intervention as implemented in the study included Course 1 and Course 2 of the *Core-Plus Mathematics* curriculum. The *Core-Plus Mathematics* Course 1 curriculum was used with ninth-grade students in year one, and *Core-Plus Mathematics* Course 2 was for tenth-grade students in year two. The authors note that the field-test versions of the *Core-Plus Mathematics* curriculum used in the study underwent revisions prior to the curriculum's formal publication.
Comparison	According to the authors, the nature of the instruction in the comparison classrooms was not specified in advance; a variety of traditional textbooks were used. Comparison classrooms during year one included 20 Algebra, five Pre-algebra, three General Mathematics, and two ninth-grade accelerated Geometry classes. Students in the year two comparison group were enrolled in either Algebra, Geometry, or Accelerated Advanced Algebra.
Primary outcomes and measurement[1]	Student math achievement was assessed using several measures. The full analysis sample for years one and two completed the Iowa Tests of Educational Development mathematics subtest. Slightly smaller numbers of students completed two author-created outcome measures: the Course 1 CPMP Posttest and Course 2 CPMP Posttest. The SAT Mathematics subtest also served as an outcome measure for a subsample of students. For a more detailed description of these outcome measures, see Appendix A2.
Staff/teacher training	From each school, a minimum of one *Core-Plus Mathematics* teacher attended a two-week workshop prior to teaching a *Core-Plus Mathematics* course. In this workshop, teachers worked through the course materials by using a small-group investigative approach similar to the one that they would be using with their own students. The comparison teachers had no special in-service program.

1. The study presented analyses on additional outcomes that are not included in this report. The samples for the ITED-Q two year trend analysis, NAEP, and college placement exam analyses were not equivalent at baseline; there was too much time between the establishment of equivalence (6th grade) and the start of the treatment (9th grade) for the ACT analysis; and the college performance outcomes are out of scope for this review.

Appendix A2 Outcome measures for the mathematics achievement domain

Outcome measure	Description
Iowa Tests of Educational Development Mathematics subtest (ITED-Q)	This nationally standardized achievement test is designed to measure skills on quantitative thinking processes that are important for anyone with at least a high school education. It is divided into three subtests (Understanding Mathematical Concepts and Procedures, Interpreting Information, and Solving Problems), and includes questions on whole numbers, exponents, fractions, decimals, percents, ratios, geometry, measurement, estimation, rounding, statistics, probability, tables, and graphs (as cited in Schoen & Hirsch, 2002).
Course 1 CPMP Posttest (Part 1)	This author-designed open-ended achievement test was designed to be a test of content that both *Core-Plus Mathematics* and comparison students would have had an opportunity to learn. It is divided into three subtests: two contextual subtests requiring algebraic methods, and a third subtest of procedural algebra. Specifically, the first two subtests require students to demonstrate their comprehension of algebraic concepts, such as linear equations, tables and graphs, and inequalities, by applying and interpreting them to specific examples, and the third subtest requires students to solve linear equations and simplify linear expressions (as cited in Schoen & Hirsch, 2002).
Course 2 CPMP Posttest (Part 1)	This author-designed open-ended achievement test was designed to be a test of content that both *Core-Plus Mathematics* and comparison students would have had an opportunity to learn. It is divided into three subtests: two contextual subtests (one algebraic and one geometric), and a third subtest of procedural algebra. The algebra subtests are similar in design to those in the Course 1 CPMP Posttest but include some work with exponents and quadratic expressions (as cited in Schoen & Hirsch, 2002).
SAT I Mathematics subtest (SAT)	One of the components of the SAT college entrance examination (SAT I), the Mathematics subtest, measures mathematical reasoning and symbol sense, drawing on content from arithmetic, algebra, and geometry (as cited in Schoen & Hirsch, 2002).

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

Outcome measure	Study sample	Sample size (students)	Authors' findings from the study: Mean outcome (standard deviation)[2]		WWC calculations			
			Core-Plus Mathematics group	Comparison group	Mean difference[3] (*Core-Plus Mathematics* – comparison)	Effect size[4]	Statistical significance[5] (at $\alpha = 0.05$)	Improvement index[6]
Schoen & Hirsch (2002)[7]								
ITED-Q	Grade 9	1,050	266.0 (39.5)	257.1 (46.2)	8.9	0.21	Statistically significant	+8
ITED-Q	Grade 10	390	281.4 (32.0)	280.0 (32.3)	1.4	0.04	ns	+2
CPMP1 – Contextual Algebra I subtest	Grade 9	947	10.11 (4.20)	6.42 (4.22)	3.69	0.88	Statistically significant	+31
CPMP1 – Contextual Algebra II subtest	Grade 9	947	4.34 (2.64)	3.09 (2.26)	1.25	0.51	Statistically significant	+19
CPMP1 – Procedural Algebra subtest	Grade 9	947	8.92 (5.05)	10.87 (5.32)	–1.95	–0.38	Statistically significant	–15
CPMP2 – Contextual Algebra subtest	Grade 10	237	7.14 (3.97)	3.94 (2.74)	3.20	0.94	Statistically significant	+33
CPMP2 – Procedural Algebra subtest	Grade 10	237	7.54 (4.05)	8.30 (3.94)	–0.76	–0.19	ns	–8
CPMP2 – Coordinate Geometry subtest	Grade 10	237	16.10 (4.70)	11.13 (4.53)	4.97	1.07	Statistically significant	+36
SAT	Grades 11 and 12	98	484.6 (53.8)	467.0 (67.5)	17.6	0.29	ns	+11
Domain average for mathematics achievement[8]						**0.37**	**na**	**+15**

ns = not statistically significant
na = not applicable
CPMP1 = Course 1 CPMP Posttest (Part 1)
CPMP2 = Course 2 CPMP Posttest (Part 1)
ITED-Q = Iowa Tests of Educational Development Mathematics subtest
SAT = SAT I Mathematics subtest

(continued)

1. This appendix reports findings considered for the effectiveness rating and the average improvement indices for the mathematics achievement domain. Subgroup findings from the same study are not included in these ratings, but are reported in Appendix A4.
2. The standard deviation across all students in each group shows how dispersed the participants' outcomes are: a smaller standard deviation on a given measure would indicate that participants had more similar outcomes.
3. Positive differences and effect sizes favor the intervention group; negative differences and effect sizes favor the comparison group.
4. For an explanation of the effect size calculation, see WWC Procedures and Standards Handbook, Appendix B.
5. Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups.
6. The improvement index represents the difference between the percentile rank of the average student in the intervention condition and that of the average student in the comparison condition. The improvement index can take on values between –50 and +50, with positive numbers denoting favorable results for the intervention group.
7. The level of statistical significance was reported by the study authors or, when necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For the formulas the WWC used to calculate the statistical significance, see WWC Procedures and Standards Handbook, Appendix C for clustering and WWC Procedures and Standards Handbook, Appendix D for multiple comparisons. In the case of Schoen and Hirsch (2002), corrections for clustering and multiple comparisons were needed, so the significance levels may differ from those reported in the original study.
8. This row provides the study average, which in this instance is also the domain average. The WWC-computed domain average effect size is a simple average rounded to two decimal places. The domain improvement index is calculated from the average effect size.

Appendix A4 Summary of subgroup findings for the mathematics achievement domain[1]

Outcome measure	Study sample	Sample size (students)	Authors' findings from the study: Mean outcome (standard deviation)[2] — *Core-Plus Mathematics* group	Comparison group	WWC calculations: Mean difference[3] (*Core-Plus Mathematics* – comparison)	Effect size[4]	Statistical significance[5] (at $\alpha = 0.05$)	Improvement index[6]
Schoen & Hirsch (2002)[7]								
ITED-Q	Grade 9 Pre-algebra	218	240.4 (35.5)	218.8 (40.2)	21.6	0.57	Statistically significant	+21
ITED-Q	Grade 9 Algebra	734	269.2 (37.9)	262.2 (42.0)	7.0	0.17	Statistically significant	+7
ITED-Q	Grade 9 Accelerated Geometry	98	299.1 (23.7)	304.0 (21.6)	–4.9	–0.21	ns	–8
ITED-Q	Grade 10 Algebra	62	252.0 (33.2)	248.6 (22.0)	3.4	0.12	ns	+5
ITED-Q	Grade 10 Geometry	278	283.7 (28.3)	281.4 (30.1)	2.3	0.08	ns	+3
ITED-Q	Grade 10 Accelerated Advanced Algebra	50	305.0 (23.8)	311.4 (17.5)	–6.4	–0.30	ns	–12
CPMP1 – Contextual Algebra I subtest	Grade 9 Algebra	655	10.60 (3.99)	6.98 (4.07)	3.62	0.90	Statistically significant	+32
CPMP1 – Contextual Algebra II subtest	Grade 9 Algebra	655	4.56 (2.49)	3.43 (2.25)	1.13	0.48	Statistically significant	+18
CPMP1 – Procedural Algebra subtest	Grade 9 Algebra	655	9.41 (5.04)	11.90 (4.74)	–2.49	–0.51	Statistically significant	–19
CPMP1 – Contextual Algebra I subtest	Grade 9 Accelerated Geometry	91	12.48 (3.33)	9.60 (4.14)	2.88	0.76	Statistically significant	+28
CPMP1 – Contextual Algebra II subtest	Grade 9 Accelerated Geometry	91	5.91 (3.05)	4.23 (2.29)	1.68	0.62	Statistically significant	+23

(continued)

Appendix A4 Summary of subgroup findings for the mathematics achievement domain[1] *(continued)*

			Authors' findings from the study		WWC calculations			
			Mean outcome (standard deviation)[2]					
Outcome measure	Study sample	Sample size (students)	*Core-Plus Mathematics* group	Comparison group	Mean difference[3] (*Core-Plus Mathematics* – comparison)	Effect size[4]	Statistical significance[5] (at α = 0.05)	Improvement index[6]
CPMP1 – Procedural Algebra subtest	Grade 9 Accelerated Geometry	91	11.75 (4.80)	14.89 (3.77)	–3.14	–0.72	Statistically significant	–27
CPMP2 – Contextual Algebra subtest	Grade 10 Algebra	58	7.04 (4.05)	2.54 (2.05)	4.50	1.41	Statistically significant	+42
CPMP2 – Procedural Algebra subtest	Grade 10 Algebra	58	7.23 (4.41)	6.26 (2.86)	0.97	0.26	ns	+10
CPMP2 – Coordinate Geometry subtest	Grade 10 Algebra	58	13.15 (3.75)	8.26 (3.41)	4.89	1.35	Statistically significant	+41
CPMP2 – Contextual Algebra subtest	Grade 10 Geometry	136	6.70 (3.99)	3.99 (2.83)	2.71	0.78	Statistically significant	+28
CPMP2 – Procedural Algebra subtest	Grade 10 Geometry	136	7.23 (4.41)	7.51 (3.19)	–0.28	–0.07	ns	–3
CPMP2 – Coordinate Geometry subtest	Grade 10 Geometry	136	16.84 (4.66)	10.97 (4.19)	5.87	1.32	Statistically significant	+41

ns = not statistically significant
CPMP1 = Course 1 CPMP Posttest (Part 1)
CPMP2 = Course 2 CPMP Posttest (Part 1)
ITED-Q = Iowa Tests of Educational Development Mathematics subtest

1. This appendix presents subgroup findings for measures that fall in the mathematics achievement domain. Aggregated scores were used for rating purposes and are presented in Appendix A3. Results on the Course 1 CPMP Posttest for the Pre-algebra subgroup and Course 2 CPMP Posttest for the Accelerated Advanced Algebra subgroup are not included because the groups were not equivalent at baseline and the analyses did not control for pretest differences.
2. The standard deviation across all students in each group shows how dispersed the participants' outcomes are: a smaller standard deviation on a given measure would indicate that participants had more similar outcomes.
3. Positive differences and effect sizes favor the intervention group; negative differences and effect sizes favor the comparison group.
4. For an explanation of the effect size calculation, see WWC Procedures and Standards Handbook, Appendix B.
5. Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups.
6. The improvement index represents the difference between the percentile rank of the average student in the intervention condition and that of the average student in the comparison condition. The improvement index can take on values between –50 and +50, with positive numbers denoting results favorable to the intervention group.
7. The level of statistical significance was reported by the study authors or, when necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For the formulas the WWC used to calculate the statistical significance, see WWC Procedures and Standards Handbook, Appendix C for clustering and WWC Procedures and Standards Handbook, Appendix D for multiple comparisons. In the case of Schoen and Hirsch (2002), corrections for clustering and multiple comparisons were needed, so the significance levels may differ from those reported in the original study.

Appendix A5 *Core-Plus Mathematics* rating for the mathematics achievement domain

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

For the outcome domain of mathematics achievement, the WWC rated *Core-Plus Mathematics* as having potentially positive effects for high school students. The remaining ratings (mixed effects, no discernible effects, potentially negative effects, and negative effects) were not considered, as *Core-Plus Mathematics* was assigned the highest applicable rating.

Rating received

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

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

  Met. The sole study showed a statistically significant positive effect.

AND

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

  Met. The sole study showed a statistically significant positive effect.

Other ratings considered

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

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

  Not met. Only one study showed a statistically significant positive effect.

AND

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

  Met. The sole study showed a statistically significant positive effect.

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

Appendix A6 Extent of evidence by domain

Outcome domain	Number of studies	Sample size: Schools	Sample size: Students	Extent of evidence[1]
Mathematics achievement	1	11	1,050	Small

1. A rating of "medium to large" requires at least two studies and two schools across studies in one domain and a total sample size across studies of at least 350 students or 14 classrooms. Otherwise, the rating is "small." For more details on the extent of evidence categorization, see the WWC Procedures and Standards Handbook, Appendix G.