WWC Intervention Report

A summary of findings from a systematic review of the evidence

INSTITUTE OF EDUCATION SCIENCES

Connected Mathematics Project (CMP)

Intervention Description[1]

Connected Mathematics Project (CMP) is a math curriculum for students in grades 6–8. It uses interactive problems and everyday situations to explore mathematical ideas, with a goal of fostering a problem-centered, inquiry-based learning environment. At each grade level, the curriculum covers numbers, algebra, geometry/measurement, probability, and statistics.

Research[2]

The What Works Clearinghouse (WWC) identified two studies of *CMP* that both fall within the scope of the Primary Mathematics topic area and meet WWC group design standards.[3] No studies meet WWC group design standards without reservations; the two studies meet WWC group design standards with reservations. Together, these studies included 3,062 students in grades 6–8 in at least 23 schools in 10 locations.[4]

The WWC considers the extent of evidence for *CMP* on the mathematics achievement of students in primary mathematics courses to be medium to large for the mathematics achievement domain, the only domain examined for studies reviewed under the Primary Mathematics topic area.[5] (See the Effectiveness Summary on p. 4 for more details of effectiveness by domain.)

Report Contents

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

Effectiveness

CMP was found to have no discernible effects on mathematics achievement for students in primary mathematics courses.

Table 1. Summary of findings[6]

Outcome domain	Rating of effectiveness	Improvement index *(percentile points)* Average	Improvement index *(percentile points)* Range	Number of studies	Number of students	Extent of evidence
Mathematics achievement	No discernible effects	+2	0 to +4	2	3,062	Medium to large

Intervention Information

Background

CMP was developed by Michigan State University and is distributed by Pearson Education. Address: P.O. Box 6820, Chandler, AZ 85246. Email: k12customerservice@pearson.com. Web: https://connectedmath.msu.edu/. Telephone: (800) 848-9500.

Intervention details

CMP is an inquiry-based mathematics curriculum. Mathematical ideas are embedded in sequenced sets of tasks and explored in depth to help students develop a thorough understanding of mathematical concepts. Throughout the curriculum, students focus on problem-solving strategies, communicating their reasoning, offering proofs, and using representations.

CMP includes four courses: Grade 6 Mathematics, Grade 7 Mathematics, Grade 8 Mathematics, and Algebra I. Each course is organized into units, with seven to eight units per course, with units organized around a mathematical concept or set of related concepts, such as area and perimeter, or operations on fractions.[7]

CMP seeks to promote students' mathematical knowledge and understanding by helping them understand the connections among mathematics topic areas and between mathematics and other academic subjects. Students move flexibly between graphic, numeric, symbolic, and verbal representations to develop fluency in conceptual and procedural knowledge.

The publisher is currently selling the third edition of *CMP*. The developer's website describes how the curriculum has been refined and enhanced from the first and second editions.[8]

Cost

As of July 2016, the cost of *CMP* varies between $73.97 and $127.97 per student for the full curriculum, depending on the grade level and type of implementation (digital, print, or a combination of formats). Manipulatives kits cost between $221.97 and $313.47 each, and a teacher resource kit costs $524.97. More detailed cost information is available from the publisher.

Research Summary

The WWC identified 24 eligible studies that investigated the effects of *CMP* on the mathematics achievement of primary students. An additional 76 studies were identified but do not meet WWC eligibility criteria for review in this topic area. Citations for all 100 studies are in the References section, which begins on p. 5.

Table 2. Scope of reviewed research

Grade	6, 7, 8
Delivery method	Whole class
Intervention type	Curriculum

The WWC reviewed 24 eligible studies against group design standards. None of the 24 studies are randomized controlled trials that meet WWC group design standards without reservations. Two of the 24 studies use quasi-experimental designs and meet WWC group design standards with reservations. Those two studies are summarized in this report. The remaining 22 studies do not meet WWC group design standards.

Summary of studies meeting WWC group design standards without reservations

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

Summary of studies meeting WWC group design standards with reservations

Cai, Wang, Moyer, Wang, and Nie (2011) examined the effect of the *CMP* curriculum by matching seven schools using the *CMP* curriculum to seven schools not using the curriculum on comparable demographic characteristics. All 14 schools were located in a single large, urban school district. Students in the intervention schools used *CMP* in the sixth, seventh, and eighth grades. Students in the comparison schools did not use *CMP*. The study involved a single cohort of students who were followed over six school years (2005–06 through 2010–11), from grade 6 to grade 11.[9] All but the analyses of ninth and tenth grade outcomes meet WWC group design standards with reservations. The WWC based its effectiveness rating on outcomes measured at the end of eighth grade. The eighth-grade analytic sample included 303 students in the *CMP* group and 303 students in the comparison group in 14 schools. The study used the first edition of *CMP*.

Ridgway, Zawojewski, Hoover, and Lambdin (2002) conducted a study using a quasi-experimental design in which two classrooms from each of nine sites across the country used *CMP*. Five sites were in the Midwest, two were in the West, and two were in the East. For every two *CMP* classrooms, one non-*CMP* classroom was recruited for the study. The authors matched the *CMP* classrooms to non-*CMP* classrooms based on student ability, urbanicity, diversity in student population, and algebra or pre-algebra tracks. In five sites, there were both *CMP* and comparison classrooms. In the other four *CMP* sites, comparison classrooms were recruited from other locations. Data for the sixth- and seventh-grade analytic samples were collected in the 1994–95 school year and included 36 *CMP* classrooms and 18 comparison classrooms. Data for the eighth-grade sample was collected in the 1995–96 school year, and included 14 *CMP* classrooms and seven comparison classrooms. The WWC based its effectiveness rating on outcomes combined across students in all three grades. Although some intervention students used *CMP* in a previous school year, the findings from this study measure the effectiveness of receiving 1 year of the intervention because the pre-intervention measures were assessed at the beginning of same school year in which outcomes were measured. The analytic sample included a total of 2,456 students across these 75 classrooms. The study did not specify which edition of *CMP* was used, but based on the timing of the study, it was likely the first edition.

Effectiveness Summary

The WWC review of *CMP* for the Primary Mathematics topic area includes student outcomes in one domain: mathematics achievement. The findings below present the authors' estimates and WWC-calculated estimates of the size and statistical significance of the effects of *CMP* on primary students. Additional comparisons are presented as supplemental findings in Appendix D. These supplemental findings do not factor into the intervention's rating of effectiveness. For a more detailed description of the rating of effectiveness and extent of evidence criteria, see the WWC Rating Criteria on p. 23.

Summary of effectiveness for the comprehension domain

Table 3. Rating of effectiveness and extent of evidence for the mathematics achievement domain

Rating of effectiveness	Criteria met
No discernible effects *No evidence of statistically significant or substantively important effects, either positive or negative.*	In the two studies that reported findings, the estimated impact of the intervention on outcomes in the *mathematics achievement* domain was neither statistically significant nor large enough to be considered substantively important.
Extent of evidence	**Criteria met**
Medium to large	Two studies that included 3,062 students across at least 23 schools reported evidence of effectiveness in the *mathematics achievement* domain.

Two studies that meet WWC group design standards with reservations reported findings in the mathematics achievement domain.

Cai et al. (2011) reported, and the WWC confirmed (after applying a correction for classroom-level clustering), no statistically significant or substantively important difference between the *CMP* group and the comparison group in the mathematics achievement domain. The WWC characterizes these study findings as an indeterminate effect.

Ridgway et al. (2002) reported a statistically significant difference between the *CMP* group and the comparison group in the mathematics achievement domain. However, after applying a correction for classroom-level clustering, the WWC found that this difference was no longer statistically significant and the result was not substantively important. The WWC characterizes these study findings as an indeterminate effect.

Thus, for the mathematics achievement domain, neither study showed effects that were statistically significant nor large enough to be considered substantively important. This results in a rating of no discernible effects, with a medium to large extent of evidence.

References

Studies that meet WWC group design standards without reservations

None.

Studies that meet WWC group design standards with reservations

Cai, J., Wang, N., Moyer, J. C., Wang, C., & Nie, B. (2011). Longitudinal investigation of the curricular effect: An analysis of student learning outcomes from the LieCal project in the United States. *International Journal of Educational Research, 50*(2), 117–136.

Additional sources:

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Cai, J., Hwang, S., & Moyer, J.C. (2016) Mathematical problem posing as a measure of curricular effect on students' learning: A response. *Educational Studies in Mathematics, 91*(1), 9–10.

Cai, J., & Moyer, J. C. (2006, July). *A conceptual framework for studying curricular effects on students' learning: Conceptualization and design in the LieCal project.* Poster presented at the 2006 Annual Meeting of the International Group of Psychology of Mathematics Education, Prague, Czech Republic.

Cai, J., Moyer, J. C., & Wang, N. (2013). Longitudinal investigation of the effect of middle school curriculum on learning in high school. In A. Lindmeier & A. Heinze (Eds.), *The proceedings of the 37th conference of the International Group for the Psychology of Mathematics Education* (pp. 137–144). Kiel, Germany: The International Group for the Psychology of Mathematics Education.

Cai, J., Moyer, J. C., Wang, N., Hwang, S., Nie, B., & Garber, T. (2013). Mathematical problem posing as a measure of curricular effect on students' learning. *Educational Studies in Mathematics, 83*(1), 57–69.

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Cai, J., Yujing N., & Hwang, S. (2015). Measuring change in mathematics learning with longitudinal studies: Conceptualization and methodological issues. In J. Middleton, J. Cai, & S. Hwang (Eds.), *Large-scale studies in mathematics education* (pp. 293–309). Gewerbestrasse, Switzerland: Springer International Publishing.

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Ridgway, J. E., Zawojewski, J. S., Hoover, M. N., & Lambdin, D. V. (2002). Student attainment in the Connected Mathematics curriculum. In S. L. Senk & D. R. Thompson (Eds.), *Standards-based school mathematics curricula: What are they? What do students learn?* (pp. 193–224). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Additional source:

Hoover, M., Zawojewski, J. S., & Ridgway, J. E. (1997, April). *Effects of the Connected Mathematics Project on student attainment.* Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL.

Studies that do not meet WWC group design standards

Ben-Chaim, D., Fey, J. T., Fitzgerald, W. M., Benedetto, C., & Miller, J. (1997, April). *Development of proportional reasoning in a problem-based middle school curriculum*. Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL. Retrieved from http://eric.ed.gov/?id=ED412091 The study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Additional sources:

Ben-Chaim, D., Fey, J. T., Fitzgerald, W. M., Benedetto, C., & Miller, J. (1997, April). *A study of proportional reasoning among seventh and eighth grade students*. Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL.

Ben-Chaim, D., Fey, J. T., Fitzgerald, W. M., Benedetto, C., & Miller, J. (1998). Proportional reasoning among seventh grade students with different curricular experiences. *Educational Studies in Mathematics, 36*(3), 247–273.

Bouck, E. C., Kulkarni, G., & Johnson, L. (2011). Mathematical performance of students with disabilities in middle school: Standards-based and traditional curricula. *Remedial and Special Education, 32*(5), 429–443. The study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Cain, J. S. (2002). An evaluation of the Connected Mathematics Project. *Journal of Educational Research, 32*(4), 224–233. The study does not meet WWC group design standards because the measures of effectiveness cannot be attributed solely to the intervention.

Cavanagh, J. M. (2012). *An organizational case study: The impact of an initiation, implementation, and institutionalization of a curricular change* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 1015379520) The study does not meet WWC group design standards because the measures of effectiveness cannot be attributed solely to the intervention.

Clarkson, L. M. C. (2001). *The effects of the Connected Mathematics Project on middle school mathematics achievement* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 9997642) The study does not meet WWC group design standards because the measures of effectiveness cannot be attributed solely to the intervention.

Eddy, R. M., Berry, T., Aguirre, N., Wahlstrand, G., Ruitman, T., & Mahajan, N. (2008). *The effects of Connected Mathematics Project 2 on student performance: Randomized control trial, final report.* Claremont, CA: Claremont Graduate University, Institute of Organizational and Program Evaluation Research. The study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Ellis, J. D. (2011). Middle school mathematics: A study of three programs in south Texas. (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 3483008) The study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Fauth, T. (2007). *Using the Connected Math Project to improve seventh grade math scores at Wapato Middle School* (Unpublished master's thesis). Heritage University, Toppenish, WA. The study does not meet WWC group design standards because the measures of effectiveness cannot be attributed solely to the intervention.

King, D. A. (2007). *A study to ascertain the effects of the Connected Mathematics Project on student achievement in the Buffalo public schools* (Unpublished master's thesis). State University of New York at Buffalo. The study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Kramer, S., Cai, J., & Merlino, F. J. (2015). A lesson for the Common Core standards era from the NCTM standards era: The importance of considering school-level buy-in when implementing and evaluating standards-based instructional materials. In J. Middleton, J. Cai, & S. Hwang (Eds.), *Large-scale studies in mathematics education* (pp. 17–44). Gewerbestrasse, Switzerland: Springer International Publishing. The study does not meet WWC group design standards because the measures of effectiveness cannot be attributed solely to the intervention.

Martin, T., Brasiel, S. J., Turner, H., & Wise, J. C. (2012). *Effects of the Connected Mathematics Project 2 (CMP2) on the mathematics achievement of grade 6 students in the mid-Atlantic region. Final report* (NCEE 2012-4017). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. Retrieved from http://eric.ed.gov/?id=ED530513 The study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Mathis, E. (2004). *A comparison of two NSF funded middle school mathematics curricula in Delaware's Appoquinimink and Caesar Rodney school districts* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 765270181) The study does not meet WWC group design standards because the measures of effectiveness cannot be attributed solely to the intervention.

Monaghan, S. R. (2013). *Textbooks, teachers, and middle school mathematics student achievement* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 1469609858) The study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

O'Clair, K. K. (2005). *Impact on student achievement: Going to scale with a middle school math initiative.* (Unpublished doctoral dissertation). University of Denver, CO. The study does not meet WWC group design standards because the measures of effectiveness cannot be attributed solely to the intervention.

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Rohendi, D., & Dulpaja, J. (2013). Connected Mathematics Project (CMP) model based on presentation media to the mathematical connection ability of junior high school student. *Journal of Education and Practice, 4*(4), 17–22. The study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Schneider, C. L. (2000). *Connected Mathematics and the Texas Assessment of Academic Skills* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 3004373) The study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Tarr, J. E., Reys, R. E., Reys, B. J., Chavez, O., Shih, J., & Osterlind, S. J. (2008). The impact of middle-grades mathematics curricula and the classroom learning environment on student achievement. *Journal for Research* *in Mathematics Education, 39*(3), 247–280. The study does not meet WWC group design standards because the measures of effectiveness cannot be attributed solely to the intervention.

Additional source:

Reys, R., Reys, B., Tarr, J., & Chavez, O. (2006). *Assessing the impact of standards-based middle school mathematics curricula on student achievement and the classroom learning environment*. Washington, DC: National Center for Education Research.

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Winking, D. (1998). *The Minneapolis Connected Mathematics Project: Year Two evaluation*. Minneapolis, MN: Minneapolis Public Schools. The study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

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Winking, D. (2000b). *Minneapolis data: Excerpts from the Year One evaluation report*. East Lansing, MI: Connected Mathematics Project.

Zvoch, K., & Stevens, J. (2006). Longitudinal effects of school context and practice on middle school mathematics achievement. *The Journal of Educational Research, 99*(6), 347–357. The study does not meet WWC group design standards because equivalence of the analytic intervention and comparison groups is necessary and not demonstrated.

Studies that are ineligible for review using the Primary Mathematics Evidence Review Protocol

Adams, L. M., Tung, K. K., Warfield, V. M., Knaub, K., Mudavanhu, B., & Yong, D. (2000). *Middle school mathematics comparisons for Singapore Mathematics, Connected Mathematics Program, and Mathematics in Context (including comparisons with the NCTM Principles and Standards 2000)* (Unpublished manuscript). University of Washington, Seattle. This study is ineligible for review because it does not use an eligible design.

Adams, R. L. (2005). *Standards-based accountability: Improving achievement for all students through standards-based mathematics instruction* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 3180485) This study is ineligible for review because it is out of scope of the protocol.

Anderson, V. J. (2010). Connected Mathematics Project, 2nd edition, implementation in Seattle: The experience of teachers and principals. *Dissertation Abstracts International Section A: Humanities and Social Sciences, 71* (2-A), 432. This study is ineligible for review because it does not use an eligible design.

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Bay, J. M. (1999). Middle school mathematics curriculum implementation: The dynamics of change as teachers introduce and use standards-based curricula. *Dissertation Abstracts International, 60*(12). This study is ineligible for review because it is out of scope of the protocol.

Bay, J. M., Beem, J. K., Reys, R. E., Papick, I., & Barnes, D. E. (1999). Student reactions to standards-based mathematics curricula: The interplay between curriculum, teachers, and students. *School Science and Mathematics, 99*(4), 182–188. This study is ineligible for review because it is out of scope of the protocol.

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Bieda, K. N. (2010). Enacting proof-related tasks in middle school mathematics: Challenges and opportunities. *Journal for Research in Mathematics Education, 41*(4), 351–382. This study is ineligible for review because it is out of scope of the protocol.

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Bray, M. S. (2005). *Achievement of eighth grade students in mathematics after completing three years of the Connected Mathematics Project* (Unpublished doctoral dissertation). University of Tennessee, Knoxville. This study is ineligible for review because it does not use an eligible design.

Cady, J. A., Hodges, T. E., & Collins, R. L. (2015). A comparison of textbooks' presentation of fractions. *School Science & Mathematics, 115*(3), 105–116. doi:10.1111/ssm.12108. This study is ineligible for review because it is out of scope of the protocol.

Camenga, K. A., & Johnson Yates, R. B. (2014). Connecting the dots: Rediscovering continuity. *Mathematics Teacher, 108*(3), 212–217. This study is ineligible for review because it does not use an eligible design.

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Collins, A. M. (2002). What happens to student learning in mathematics when a multi-faceted, long-term professional development model to support standards-based curricula is implemented in an environment of high stakes testing? *Dissertation Abstracts International, 65*(2). This study is ineligible for review because it does not use an eligible design.

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Halat, E. (2007). Reform-based curriculum & acquisition of the levels. *Eurasia Journal of Mathematics, Science & Technology Education, 3*(1), 41–49. This study is ineligible for review because it is out of scope of the protocol.

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Krebs, A. S. (2003). Middle grades students' algebraic understanding in a reform curriculum. *School Science and Mathematics, 103*(5), 233–245. This study is ineligible for review because it does not use an eligible design.

Additional source:

Krebs, A. S. (1999). *Students' algebraic understanding: A study of middle grades students' ability to symbolically generalize functions* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (UMI No. 9936570)

Kulm, G., Capraro, R. M., & Capraro, M. M. (2007). Teaching and learning middle grades mathematics with understanding. *Middle Grades Research Journal, 2*(1), 23–48. This study is ineligible for review because it does not use an eligible design.

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Lappan, G., Phillips, E. D., Fey, J. T., & Friel, S. N. (2014). *A guide to Connected Mathematics 3*: *Understanding, implementing, and teaching.* Boston, MA: Pearson. This study is ineligible for review because it does not use an eligible design.

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Lubienski, S. T. (2000b). Problem solving as a means toward mathematics for all: An exploratory look through a class lens. *Journal for Research in Mathematics Education, 31*(4), 455–482. This study is ineligible for review because it does not use an eligible design.

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Moyer, J. C., Cai, J., Wang, N., & Nie, B. (2011). Impact of curriculum reform: Evidence of change in classroom practice in the United States. *International Journal of Educational Research, 50*(2), 87–99. This study is ineligible for review because it is out of scope of the protocol.

Newton, J., Geller, R., Umbeck, L., & Kasmer, L. (2012). Reflections on teaching with a standards-based curriculum: A conversation among mathematics educators. *Montana Mathematics Enthusiast, 9*(1), 179–192. This study is ineligible for review because it does not use an eligible design.

Newton, J. A. (2012). Investigating the mathematical equivalence of written and enacted middle school standards-based curricula: Focus on rational numbers. *International Journal of Educational Research, 51*, 66–85. This study is ineligible for review because it does not use an eligible design.

Nie, B., Freedman, T., Hwang, S., Wang, N., Moyer, J., & Cai, J. (2013). An investigation of teachers' intentions and reflections about using standards-based and traditional textbooks in the classroom. *ZDM Mathematics Education, 45*(5), 699–711. This study is ineligible for review because it is out of scope of the protocol.

O'Neal, S. W., & Robinson-Singer, C. (2003). *The Arkansas statewide systemic initiative pilot of the Connected Mathematics Project: An evaluation report.* Albuquerque, NM: Accountability & Development Associates, Inc. This study is ineligible for review because it does not use an eligible design.

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Schoenfeld, A., Burkhardt, H., Daro, P., Ridgeway, J., Schwartz, J., & Wilcox, S. (1999). *Balanced assessment: Middle grades assessment.* New York, NY: Dale Seymour Publications. This study is ineligible for review because it is out of scope of the protocol.

Sinclair, N., & Armstrong, A. (2011). Tell a piecewise story. *Mathematics Teaching in the Middle School, 16*(6), 346–353. This study is ineligible for review because it does not use an eligible design.

Slavin, R. E., Lake, C., & Groff, C. (2009). Effective programs in middle and high school mathematics: A best-evidence synthesis. *Review of Educational Research, 79*(2), 839–911. This study is ineligible for review because it does not use an eligible design.

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Woodward, J., & Brown, C. (2006). Meeting the curricular needs of academically low-achieving students in middle grade mathematics. *The Journal of Special Education, 40*(3), 151. Retrieved from http://eric.ed.gov/?id=EJ758177 This study is ineligible for review because it does not use a sample aligned with the protocol.

Zawojewski, J. S., Robinson, M., & Hoover, M. (1999). Reflections on developing formal mathematics and the Connected Mathematics Project. *Mathematics Teaching in the Middle School, 4*(5), 324–330. This study is ineligible for review because it does not use an eligible design.

Appendix A.1: Research details for Cai et al. (2011)

Cai, J., Wang, N., Moyer, J. C., Wang, C., & Nie, B. (2011). Longitudinal investigation of the curricular effect: An analysis of student learning outcomes from the LieCal project in the United States. *International Journal of Educational Research, 50*(2), 117–136.[10]

Additional sources:

Cai, J. (2015). Curriculum reform and mathematics learning: Evidence from two longitudinal studies. In S. J. Cho (Ed.), *Selected regular lectures from the 12th International Congress on Mathematical Education* (pp. 71–92). Gewerbestrasse, Switzerland: Springer International Publishing.

Cai, J., Moyer, J. C., & Wang, N. (2013). Longitudinal investigation of the effect of middle school curriculum on learning in high school. In A. Lindmeier & A. Heinze (Eds.), *The proceedings of the 37th conference of the International Group for the Psychology of Mathematics Education* (pp. 137–144). Kiel, Germany: The International Group for the Psychology of Mathematics Education.

Cai, J., Moyer, J. C., Wang, N., Hwang, S., Nie, B., & Garber, T. (2013). Mathematical problem posing as a measure of curricular effect on students' learning. *Educational Studies in Mathematics, 83*(1), 57–69.

Table A1. Summary of findings

Meets WWC group design standards with reservations

		Study findings	
Outcome domain	Sample size	Average improvement index *(percentile points)*	Statistically significant
Mathematics achievement	14 schools/606 students	+4	No

Setting The study was conducted in 14 middle schools, all of which were located in a single large, urban school district in the United States.

Study sample Seven middle schools that implemented *CMP* in grades 6–8 were selected for the study. Another seven middle schools in the district that were not implementing *CMP* were selected for the study's comparison group, based on their similarity to the *CMP* schools on demographic characteristics. The study sample consisted of students who began sixth grade in fall 2005. Students in both the *CMP* and comparison groups were assessed in fall 2005 (at the beginning of sixth grade), and in spring 2006, spring 2007, and spring 2008 (at the end of each grade). The eighth-grade analytic sample, assessed in spring 2008, consisted of 606 students with an equal number of students and schools in the intervention and comparison groups. The analytic sample was about half the size of the baseline sample, which included 1,284 students. About 85% of the students in the baseline sample were minorities: 64% were African American, 16% were Hispanic, 4% were Asian, and 1% were Native American. The remaining 15% of the students were White.

In addition, the *CMP* and comparison students were tracked into high school and outcomes were assessed at the end of each grade in ninth, tenth, and eleventh grades (spring 2009, spring 2010, and spring 2011). In the 10 high schools that were included in this follow-up sample, the *CMP* and comparison students were mixed together in the same classrooms and used the same (non-*CMP*) curricula.

The eighth-grade findings are considered the main outcomes in this review and presented in Appendix C because they are the most immediate outcome measuring the 3 full years of *CMP* use. The sixth-, seventh-, and eleventh-grade outcomes are considered supplemental findings presented in Appendix D that do not factor into the intervention's rating of effectiveness.[11]

Intervention group

Students in the intervention schools used the first edition of *CMP* (version 1) as their core mathematics curriculum in the sixth, seventh, and eighth grades in the 2005–06 through 2007–08 school years; specific details about how *CMP* was implemented in study schools are not provided by the authors.

Comparison group

Students in the comparison schools used one of several traditional mathematics curricula already in use in their schools during each grade (grades 6, 7, and 8); specific details about how the comparison curricula were implemented are not provided by the authors. The authors conducted detailed analyses on the curricular materials to examine differences between *CMP* and one of the curricula used by the comparison group (*Glencoe*). The authors noted that there were differences between *CMP* and non-*CMP* curriculum; notably, *CMP* emphasizes problem solving while the non-*CMP* curricula take a more traditional approach that focuses on concepts and procedures. The authors also indicate that there were some differences between the different non-*CMP* curricula, but the differences between the comparison curricula were not substantial since they took the same traditional approach to math instruction. The authors did not name the other math curricula used by students in the comparison group.

Outcomes and measurement

The study included two outcome measures that meet WWC review requirements and fall within the mathematics achievement domain: (a) open-ended tasks and (b) ability to pose problems. Both assessments were developed by the researchers involved in the study. The first assessment was administered four times: at the beginning of sixth grade (fall 2005), at the end of sixth grade (spring 2006), at the end of seventh grade (spring 2007), and at the end of eighth grade (spring 2008). The second outcome was measured at the end of eleventh grade (spring 2011). For a more detailed description of the outcome measures, see Appendix B.

The study also examined five outcomes that do not meet WWC standards. Three middle school assessments were used in analyses that did not meet standards because the *CMP* and comparison groups were not found to be equivalent at baseline: (a) translation, (b) computation, and (c) equation solving. Two additional outcomes, the Classroom Assessment Based on Standards (CABS) administered in ninth grade and the state mathematics achievement test administered in tenth grade, do not meet standards because the authors did not provide evidence of baseline equivalence for the analytic sample.

Five other outcomes used by the authors were not eligible for review. Three middle school outcomes are ineligible because they are measures of implementation fidelity: (a) the level of conceptual and procedural emphasis in lessons, (b) the difficulty of instructional tasks, and (c) the difficulty of homework problems. Two eleventh-grade outcomes are ineligible because they were used in an analysis that drew on an ineligible design (posttest only): a graphing task and equation solving task.

Support for implementation

The authors did not provide any information on support for implementation.

Appendix A.2: Research details for Ridgway et al. (2002)

Ridgway, J. E., Zawojewski, J. S., Hoover, M. N., & Lambdin, D. V. (2002). Student attainment in the Connected Mathematics curriculum. In S. L. Senk & D. R. Thompson (Eds.), *Standards-based school mathematics curricula: What are they? What do students learn?* (pp. 193–224). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.[12]

Table A2. Summary of findings — **Meets WWC group design standards with reservations**

Outcome domain	Sample size	Study findings: Average improvement index *(percentile points)*	Study findings: Statistically significant
Mathematics achievement	9 sites/2,456 students	0	No

Setting The study was conducted in nine sites across the United States (five in the Midwest, two in the West, and two in the East). The authors do not indicate whether a site is a single school or school district.

Study sample The study sample consisted of sixth- and seventh-grade students in the 1994–95 school year and eighth-grade students in the 1995–96 school year. The intervention and comparison group participants were matched to the extent possible on ability, location, and diversity in student population. In five of the nine sites that participated in the study, only a small number of teachers were using *CMP*, so comparison classrooms were selected locally. At the four other sites, comparison classrooms were identified in alternate locations. At each site, pairs of classrooms were selected within each grade level to form the intervention group; one comparison classroom was selected for every pair of intervention classrooms. The 1994–95 sample included 338 sixth-grade students and 627 seventh-grade students from 36 classrooms (18 in each grade) who used the *CMP* curriculum and 162 sixth-grade students and 234 seventh-grade students from 18 comparison group classrooms (nine in each grade). The 1995–96 sample included 820 eighth-grade students from 14 classrooms using *CMP* and 275 students from seven comparison classrooms. The authors provided results by grade.

For this review, student data were combined across grades; the effectiveness rating is based on the combined analyses for each outcome measure and presented in Appendix C.[13] Although some intervention students in this combined analysis used *CMP* in a previous school year, the combined finding measures the effectiveness of receiving 1 year of the intervention because the pre-intervention measures were assessed at the beginning of same school year in which outcomes were measured. The authors did not report demographic characteristics of the study students.

Intervention group Students in the intervention group used *CMP* as their core math curriculum. Specific details about how *CMP* was implemented in study schools are not provided by the authors. The sixth- and seventh-grade intervention students used *CMP* in the 1994–95 school year, and the eighth-grade intervention students used *CMP* in the 1995–96 school year. The sixth-grade students had no prior use of *CMP*; however, approximately three-fourths of the seventh- and eighth-grade students had used *CMP* in the previous year. The authors did not indicate which edition of *CMP* was used, but it was likely the first edition of *CMP,* since the study was conducted between 1994–96 and the second edition of *CMP* was not developed until 2000.

Comparison group

Students in the comparison group used commercially available mathematics textbooks. The authors did not provide the name of the comparison texts, nor did they provide details about how the comparison curricula were implemented in study schools. Teachers in the comparison group did not use the *CMP* curriculum and implemented their regular curriculum.

Outcomes and measurement

The study included two outcome measures, both of which meet the review requirements and fall within the math achievement domain: (a) the Iowa Test of Basic Skills (ITBS, a standardized test) and (b) the Balanced Assessment (BA) test (developed as a collaboration between the study authors and the Balanced Assessment Project). Both tests were administered to the study students in the fall and spring of the 1994–95 school year for sixth- and seventh-grade students and in the fall and spring of the 1995–96 school year for eighth-grade students.

The grade-level analyses for the ITBS and eighth-grade analyses for the BA do not demonstrate equivalence of the analytic intervention and comparison groups. Only the sixth- and seventh-grade-level analyses for the BA test demonstrate equivalence. These BA outcomes are presented as supplemental findings in Appendix D. For a more detailed description of both outcome measures, see Appendix B.

Support for implementation

All *CMP* teachers attended a summer *CMP* workshop at Michigan State University. This workshop included sessions that involved teachers experiencing the curriculum as students as well as sessions to share methods and techniques for implementation. The authors indicate that they do not have information on how *CMP* materials were used in the classroom.

Appendix B: Outcome measures for the mathematics achievement domain

Mathematics achievement	
Balanced Assessment (BA) test	The BA test was developed in collaboration between the Balanced Assessment Project and study authors to assess reasoning, mathematical communication, mathematical problem solving, and the ability to make connections among mathematical concepts. The BA test does not mimic the language or content of the *CMP* curriculum and is therefore not considered overaligned with the intervention. The BA instrument assessed a variety of curricular topics and consisted of constructed-response items that required a range of responses: items required students to interpret real-world situations, explain their strategies, and provide justifications for their responses. Each item varied in the number of points awarded for a correct answer. Five different forms of the BA test were used. BA tests were scored by trained study staff (which included mathematics teachers, mathematics education graduate students, senior high school students, and professionals who attended a structured training) using rubrics and guidelines under the direction of the *CMP* and Balanced Assessment Project staff. The BA tests had a reported inter-rater reliability of at least 90% (as cited in Ridgway et al., 2002). This outcome is only reported as a supplemental finding in Appendix D.
Iowa Test of Basic Skills (ITBS)	The ITBS includes five subtests (Concepts, Estimation, Problem Solving, Data Interpretation, and Computation) which collectively assess numbers and operations skills and concepts, as in other standardized tests. The test includes 60 timed multiple-choice items, each worth one point. The ITBS tests were scored by the Riverside Testing Company (as cited in Ridgway et al., 2002).
Open-ended tasks	This test included students' scores on five open-ended tasks (combined into one score) adapted from the BA. The tasks tested students' high-level thinking skills as well as procedural knowledge and reasoning in problem-solving. Two middle school math teachers were trained to code and score the tests. The exact agreement between two coders was approximately 80% and agreement within one point was over 95%. The authors reported internal consistency (Cronbach's Alpha) for each measurement occasion, ranging from .65 to .77 across forms and measurement occasions (as cited in Cai et al., 2011).
Problem-posing ability	Problem-posing ability was a researcher-developed task that involved identifying an equation for a given graph and posing a real-life situation that could be represented by the graph. Students' answers were scored by two researchers using a rubric. Agreement between coders ranged from 92% to 100% (as cited in Cai et al., 2011). This outcome is only reported as a supplemental finding in Appendix D.

Appendix C: Findings included in the rating for the mathematics achievement domain

Outcome measure	Study sample	Sample size	Mean (standard deviation)		WWC calculations			p-value
			Intervention group	Comparison group	Mean difference	Effect size	Improvement index	
Cai et al. (2011)[a]								
Open-ended tasks total score	Grade 8	14 schools/ 606 students	575.00 (95.00)	565.00 (100.00)	10.0	0.10	+4	> .05
Domain average for mathematics achievemtn (Cai et al., 2011)						**0.10**	**+4**	**Not statistically significant**
Ridgway et al. (2002)[b]								
Balanced Assessment (BA)	Grades 6, 7	9 sites/ 1,361 students	nr	nr	na	na	na	Grade 6 < .001 Grade 7 < .001
Iowa Test of Basic Skills (ITBS)	Grades 6, 7, 8	9 sites/ 2,456 students	8.78 (2.88)	8.77 (2.97)	0.01	0.00	0	Grade 6 < .001 Grade 7 < .001 Grade 8 .053
Domain average for mathematics achievement (Ridgway et al., 2002)						**0.00**	**0**	**Not significantly significant**
Domain average for mathematics achievement across all studies						**0.05**	**+2**	**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 available. nr = not reported.

[a] For Cai et al. (2011), means and standard deviations in the table were obtained through an author query. A correction for clustering was needed but did not affect whether any of the contrasts were found to be statistically significant. 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 intervention (i.e., difference in mean gains between the intervention and comparison groups) to the unadjusted comparison group posttest means. 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.

[b] For Ridgway et al. (2002), the authors reported unadjusted ITBS means and standard deviations separately by grades 6, 7, and 8; the grades were pooled together by the WWC. The BA did not demonstrate equivalence when pooled across grades 6, 7, and 8, nor did it demonstrate equivalence for the grade 8 subgroup; therefore, the WWC pooled together grades 6 and 7. For the BA, the authors reported *p*-values using the results from an ANCOVA model, but did not report information needed to calculate a WWC effect size. The *p*-values presented here were reported in the original study. Corrections for clustering and multiple comparisons were needed, but the authors did not provide enough information to determine WWC significance for the BA; the WWC-computed *p*-value is .97 for the ITBS; therefore, the WWC does not find the result to be statistically significant. The WWC calculated the ITBS intervention group mean using a difference-in-differences approach by adding the impact of the intervention (i.e., difference in mean gains between the intervention and comparison groups) to the unadjusted comparison group posttest means. The WWC excludes findings without an effect size from the domain averages. 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 D: Description of supplemental findings for the mathematics achievement domain

Outcome measure	Study sample	Sample size	Mean (standard deviation)		WWC calculations			p-value
			Intervention group	Comparison group	Mean difference	Effect size	Improvement index	*p*-value
Cai et al. (2011)[a]								
Open-ended tasks total score	Grade 6	14 schools/ 606 students	494.00 (97.00)	502.00 (97.00)	–8.00	–0.08	–3	nr
Open-ended tasks total score	Grade 7	14 schools/ 606 students	538.00 (92.00)	531.00 (93.00)	7.00	0.08	+3	nr
Problem-posing performance	Grade 11 (3-year follow-up)	136 students	1.56 (1.14)	0.50 (1.17)	1.06	0.11	+4	nr
Problem-posing performance	Grade 11, middle third subgroup (3-year follow-up)	45 students	0.27 (0.87)	0.05 (0.23)	0.22	0.32	+12	nr
Problem-posing performance	Grade 11, bottom third subgroup (3-year follow-up)	45 students	0.11 (0.72)	0.00 (0.00)	0.11	0.48	+18	nr
Ridgway et al. (2002)[b]								
Balanced Assessment test	Grade 6	27 classrooms/ 500 students	nr	nr	na	na	na	< .001
Balanced Assessment test	Grade 7	27 classrooms/ 861 students	nr	nr	na	na	na	< .001

Table Notes: The supplemental findings presented in this table are additional findings from studies in this report that meet WWC design standards with or without reservations, but do not factor into the determination of the intervention rating. 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. Some statistics may not sum as expected due to rounding. na = not available. nr = not reported.

[a] For Cai et al. (2011), the unadjusted means and standard deviations reported in this table were obtained through an author query. The authors did not provide *p*-values with these data. Corrections for multiple comparisons were not implemented because the authors did not report *p*-values and the WWC-computed *p*-values did not indicate any of these findings were statistically significant. The eighth-grade findings are considered the main outcomes in this review and are presented in Appendix C because they are the most immediate outcomes measuring the 3 full years of *CMP* use. The sixth- and seventh-grade findings (which represent 1 and 2 years of *CMP* use, respectively) and eleventh-grade outcomes (which represent a 3 year follow-up) that are presented in this table are considered supplemental findings. For the eleventh-grade outcomes, the author provided data separately for the bottom, middle, and top thirds of students. The WWC examined results separately by the achievement subgroups, and combined data to estimate the effect for the full eleventh-grade sample. The author examined different eleventh-grade outcomes using two different baseline tests: an open-ended task and an equation-solving task. The full eleventh-grade sample demonstrated baseline equivalence on the open-ended task but not on the equation-solving task. The subgroup analyses for the eleventh grade only met WWC baseline equivalence standards on the open-ended task for the middle third achievement level subgroup and the equation-solving test for the bottom third achievement subgroup. The WWC calculated the intervention group mean using a difference-in-differences approach by adding the impact of the intervention (i.e., difference in mean gains between the intervention and comparison groups) to the unadjusted comparison group posttest means for all outcomes except the eleventh-grade problem-posing performance (bottom third subgroup). Please see the WWC Procedures and Standards Handbook (version 3.0) for more information.

[b] For Ridgway et al. (2002), the authors reported *p*-values using the results from an ANCOVA model, but did not report adjusted means and standard deviations. Corrections for clustering and multiple comparisons were needed but did not affect whether any of the contrasts were found to be statistically significant. The *p*-values presented here were reported in the original study.

Endnotes

[1] The descriptive information for this intervention was obtained from a publicly available source: the intervention's website (https://connectedmath.msu.edu). The WWC requests developers review the intervention description sections for accuracy from their perspective. The intervention description was provided to the developer in June 2015; however, the WWC received no response. Further verification of the accuracy of the descriptive information for this intervention is beyond the scope of this review.

[2] The WWC previously released a report on *CMP* under the Middle School Mathematics topic area in January 2010; the report was prepared using the WWC Procedures and Standards Handbook (version 1.0) and the Middle School Mathematics review protocol (version 1.0). In June 2015, the WWC restructured the reviews of research on math interventions into two areas instead of three. These two review areas are Primary Mathematics (which includes interventions in which math is presented through multi-topic materials and curricula, typically used in grades K–8), and Secondary Mathematics (which includes interventions that are organized by math content area [e.g., Algebra, Geometry, and Calculus], typically taught in grades 9–12). These two areas replaced the prior Elementary School Math, Middle School Math, and High School Math areas, which were organized by student grade level. The WWC is updating and replacing intervention reports written under the prior topic areas.

The literature search for the current report reflects documents publicly available by March 2016. This report has been updated to include reviews of 40 studies that were not included in the prior report. Of the additional studies, 31 were not within the scope of the review protocol for the Primary Mathematics topic area, and eight were within the scope of the review protocol for the Primary Mathematics topic area but did not meet WWC group design standards. One study meets WWC group design standards with reservations, and findings from this study are summarized in this report. A complete list and disposition of all studies reviewed are provided in the references.

The report includes reviews of all studies included in the previous report and resulted in a revised disposition for two studies. Ridgway et al. (2002) received a disposition in this report of *meets WWC group design standards with reservations*, where it had previously received the rating of *does not meet WWC group design standards*. The study received the previous rating because the analytic sample included some students that had prior use of the intervention. This review is based on the Primary Mathematics topic area review protocol (version 3.1), which does not prohibit prior use of an intervention, as long as the study demonstrates baseline equivalence on the analytic sample and meets all other review requirements. Using the WWC Procedures and Standards Handbook (version 3.0) and the Primary Mathematics review protocol (version 3.1), several analytic contrasts within this study meet WWC group design standards, and therefore, the study is now rated *meets WWC group design standards with reservations*.

Schneider (2000) received a disposition in this report of *does not meet WWC group design standard*s, where it had previously received a rating of *meets WWC group design standards with reservations*. This study has baseline differences in the adjustment range (0.05 to 0.25 standard deviations), and therefore must include an appropriate statistical adjustment. However, an appropriate statistical adjustment was not conducted by the author. Therefore, the prior rating was incorrect and is corrected in this report. The study is now rated *does not meet WWC group design standards*.

[3] The studies in this report were reviewed using the standards from the WWC Procedures and Standards Handbook (version 3.0), and the Primary Mathematics 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.

[4] This represents the total analytic sample size across the two studies. Cai et al. (2011) included students from 14 schools within one school district. Ridgway et al. (2002) included students from nine sites across the country; the authors did not define whether a site is a single school, a school district, or a larger entity.

[5] Please see the Primary Mathematics review protocol (version 3.1) for more information about the outcome domain.

[6] For criteria used in the determination of the rating of effectiveness and extent of evidence, see the WWC Rating Criteria on p. 23. These improvement index numbers show the average and range of individual-level improvement indices for all findings across the studies.

[7] This review does not include any studies of *CMP* Algebra I since it is not eligible for review under the WWC's Primary Mathematics review protocol.

[8] One study that meets standards and is summarized in this report provides evidence of effectiveness about the first edition of *CMP*. The other study that meets standards and is summarized in this report may also provide evidence of effectiveness about the first edition of *CMP*. While the author does not specify the edition used, due to the timing of the study, it likely provides evidence about the first edition of *CMP*.

[9] For the analyses of eleventh-grade outcomes, the authors followed students who enrolled in the 10 high schools with the largest number of *CMP* and non-*CMP* students from the original sample. The eleventh-grade outcomes included 135–136 students from the original sample of nearly 700 students. The number of classes from which the eleventh-grade sample originated was not reported by

the author. In high school, the *CMP* and non-*CMP* students were no longer separated and they used the same curriculum (which was not *CMP*).

[10] The WWC identified three additional sources related to Cai et al. (2011). These studies do not contribute unique information to Appendix A.1 and are not listed here.

[11] The ninth- and tenth-grade analytic samples did not demonstrate equivalence as required, and therefore do not meet WWC group design standards; thus, they are not presented in Appendix D.

[12] The WWC identified one additional source related to Ridgway et al. (2002). The study does not contribute unique information to Appendix A.2 and is not listed here.

[13] Although the study presented findings for each grade separately, the WWC combined this data when presenting the findings in Appendix C. Within each study and outcome domain, the WWC reports a set of primary findings from multiple outcomes that use comparable samples, when possible. When the WWC combined the data across all three grades for each outcome measure, baseline equivalence was demonstrated on the ITBS, but not on the BA. Therefore, we report as the primary findings the combined grades 6 and 7 sample for the BA, and the combined sample across all three grades for the ITBS. In addition, the two grade subgroups that demonstrated equivalence on the BA are presented as supplementary results in Appendix D.

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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. 23.

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. 23.

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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