What Works Clearinghouse

Detailed Study Report

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

Hoover, M. N., Zawojewski, J. S., & Ridgway, J. (1997, April). Effects of the Connected Mathematics Project on Student Achievement. Paper presented at the Annual Meeting of American Education Research Association, Chicago, IL.

WWC Study Reports are intended to support decision making; neither the What Works Clearinghouse (WWC) nor the U.S. Department of Education endorses any interventions. No single Study Report should be used as a basis for making policy decisions because (1) few studies are designed and implemented flawlessly and (2) all studies are tested on a limited number of participants, using a limited number of outcomes, at a limited number of times, so generalizing from one study to any context is very difficult. To highlight these issues, the WWC Study Reports describe in detail the specifics of each study, focusing primarily on studies that provide the best evidence of effects (randomized controlled trials). Systematic reviews of the evidence will be conducted to summarize the results of the individual studies.

See the WWC Brief Study Report (PDF) for a summary of this study.

Topic:	Curriculum-Based Interventions for Increasing K–12 Math Achievement—Middle School
Intervention:	Connected Mathematics Project
Research Design:	Quasi-Experimental Design with Matching
Study Rating:	✓
Date Released:	November 15, 2004
Summary of Results:	Ridgway et al. found mixed results, depending on the assessment test used. With the Balanced Assessment (BA) test, positive significant differences were found between the Connected Mathematics Project (CMP) students and non-CMP students in grades 6, 7, and 8. The results for the Iowa Test of Basic Skills (ITBS) were less favorable in the CMP group, with results ranging from negative significance in 6th grade to nonsignificance in the 7th and 8th grades. Since the analysis was done at the student level while the level of intervention assignment was done at the classroom or school level, caution should be used in interpreting the results.

✓✓ = Meets Evidence Standards ✓ = Meets Evidence Standards with Reservations X = Does Not Meet Evidence Standards

The What Works Clearinghouse (www.whatworks.ed.gov) was established in 2002 by the U.S. Department of Education's Institute of Education Sciences to provide educators, policymakers, researchers, and the public with a central and trusted source of scientific evidence of what works in education. Please email all questions and comments to info@whatworks.ed.gov. The What Works Clearinghouse is administered by the U.S. Department of Education through a contract to a joint venture of the American Institutes for Research and the Campbell Collaboration.

Intervention: Connected Mathematics Project

Operational Features

Between 1991 and 1997, the Connected Mathematics Project (CMP) received funding from the National Science Foundation (NSF) to develop a middle school mathematics curriculum for grades 6 through 8. The CMP, developed at Michigan State University, is reported to adhere to the National Council of Teachers for Mathematics (NCTM) Curriculum and Evaluation Standards.

The key feature of the CMP is that it is a comprehensive, problem-centered curriculum that provides skills practice. The CMP curriculum has 24 units, with 8 units at each grade level. Each unit contains four to seven investigations, and each investigation in turn contains one to five problem sets. Each investigation ends with a mathematical reflection activity.

Support for implementation of the CMP curriculum includes professional development prior to implementation and follow-up professional development each summer after implementation. The summer CMP institutes at Michigan State University conduct these professional development activities.

In this study, the intervention group used the CMP curriculum. Ridgway et al. report that no data exists on what textbook series were used by the comparison group. No further information about the comparison group was given by Hoover et al.

People, Settings, and Timing

This study is a large-scale, nationwide formative evaluation of the CMP curriculum. Ridgway et al. and Hoover et al. evaluate 6th- and 7th-grade students in 1994–95 and 8th-grade students in 1995–96. No same student was under study in both grades 6 and 7. However, because the same locations might have been used for the study of 8th grade the following year, a small number of 8th-grade students might also have been in the study when they were in 7th grade.

Nine sites across the country participated in the study: five in the Midwest, two in the West, and two in the East. Because Ridgway et al. and Hoover et al. do not define what they mean by sites, it is ambiguous whether site means districts or schools.

The outcome measures were administered in April, before the end of the school year.

Cost Information

Cost information on the CMP curriculum is provided on the publisher's website, www.phschool.com/math/cmp/index.html. The cost varies by the number of units purchased.

Intended Duration

The CMP curriculum covers three years, grades 6 through 8. Ridgway et al. and Hoover et al. intended to look only at the one-year achievement growths of separate samples of 6th-, 7th-, and 8th-graders. They did not intend to conduct a longitudinal study of students from grades 6 through 8 by examining their growth over three years.

Scientific Rationale

Ridgway et al. and Hoover et al. do not provide a scientific rationale for this study. The focus of the study is to provide a formative evaluation of the CMP and to determine whether there is alignment between the reform goals of the curriculum and the construct validity of assessment instruments.

Overview of the Study

Purpose

Ridgway et al. report three purposes of the study: (1) to provide accountability to NSF, the curriculum's funder; (2) to provide formative evaluation of the curriculum materials and highlight areas in need of change; and (3) to help the schools that adopt the curriculum by identifying reasonable expectations of student achievement in a norm-referenced, traditional test and in a test aligned to the reform standards.

Hoover et al. report that the purpose is to determine the alignment of the curriculum with NCTM standards. This can be determined by how students using the CMP curriculum fared on an assessment that is also aligned to the

NCTM standards compared to a commercially available norm-referenced test.

Intervention Fidelity

Ridgway et al. and Hoover et al. describe the curriculum but do not provide any information about how the curriculum was implemented at any of the sites.

Outcome Measures

Two outcome measures are used in this study—the Iowa Test of Basic Skills (ITBS) Survey Battery and the Balanced Achievement (BA) test. Both tests are given in September and April. Scores from the ITBS test taken by students in September are used as a covariate in the analysis of the BA achievement data.

The ITBS is a standardized test from Riverside Testing Company, which scores and analyzes the tests in this study using national norms. Specifically, Form K (Levels 12, 13, and 14) mathematics section of the ITBS is used, and it includes about 60 multiple-choice items that focus on specific concepts, operations, and procedures. It takes about 50 minutes to complete.

A BA project team developed the BA test in collaboration with the CMP team. Ridgway et al. and Hoover et al. report that the CMP curriculum is aligned with the NCTM standards, and the aim is to develop an assessment that also is aligned with these standards. The BA test comprises open response items, many of which require some explanation or demonstration of the approach used by the student. The test is double scored by trained scorers, such as teachers and graduate students, who work in the education field. The test takes about 45 minutes to complete, but students are given as much time as needed to complete the test. Ridgway et al. and Hoover et al. report that the BA test evenly covers the topics areas of the NCTM standards, whereas the ITBS test focuses mainly on numbers and operations.

Research Design

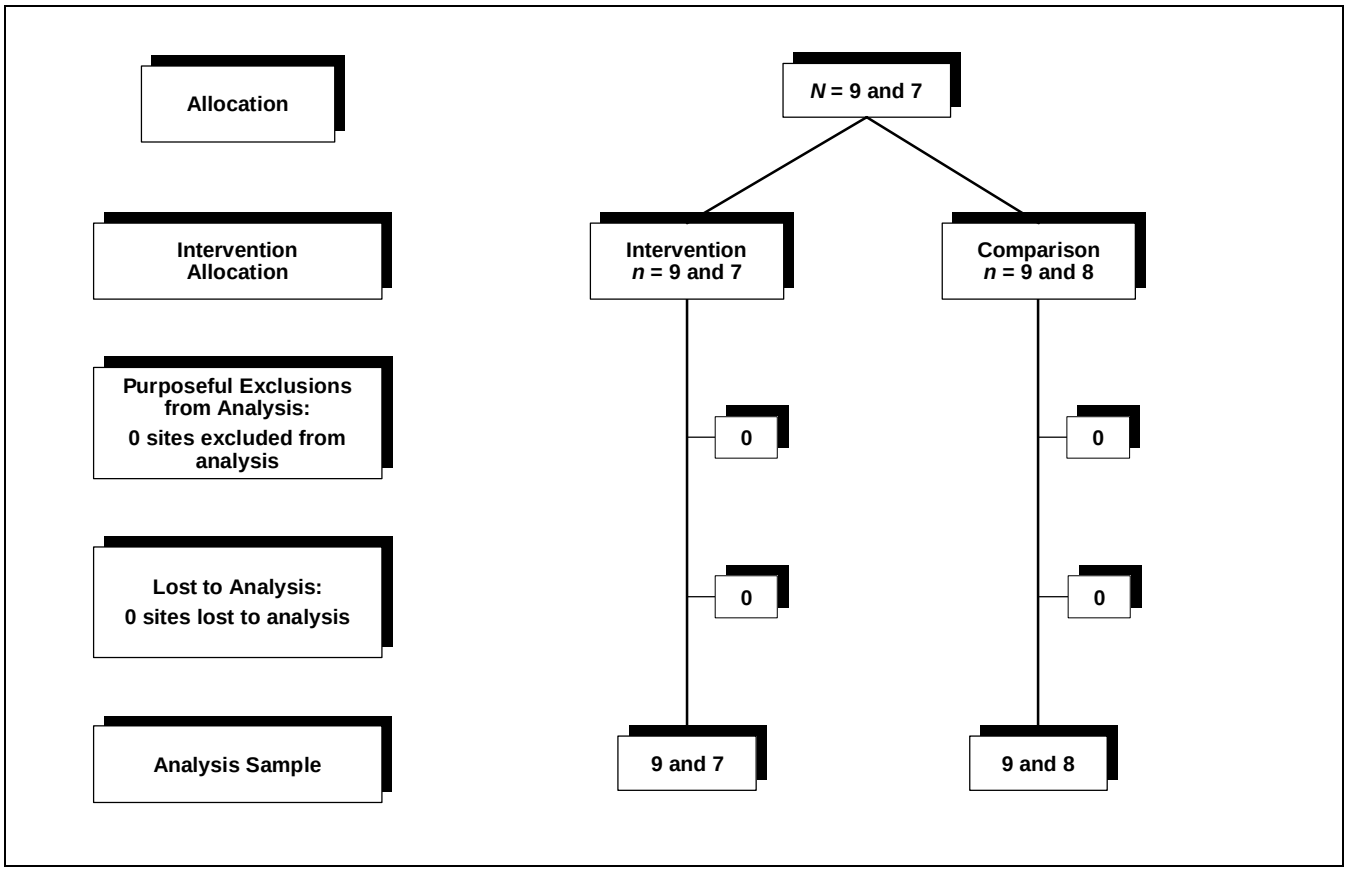
The research design for this study is quasi-experimental with matching. Ridgway et al. and Hoover et al. do not elaborate on how the CMP sample was selected for this particular study. They report that the CMP curriculum was to be used throughout the entire school year in the intervention group. Both the intervention and comparison groups were matched as much as possible on geographic location (urban–rural–suburban), student population diversity, and student ability grouping. Selection of the comparison group was done at either the school level or the classroom level. If the CMP was adopted in the whole district, than a comparable non-CMP school was selected. Otherwise, comparison classrooms were selected locally.

Analyses for this study are done at the student level. However, the level of intervention is at the school or classroom level, and caution should be used in interpreting the results.

Participant Flow

In 1994–95, nine sites participated in the study. A separate study and analysis of 1995–96 reports that two CMP sites dropped out (one changed back to a traditional curriculum, and the other had no volunteer CMP teachers). A non-CMP site, however, decided to adopt the CMP curriculum, so two small but comparable non-CMP sites were matched to it. (See Figure 1, Participant Flow.)

Figure 1. Participant Flow[a]



[a] Participant flow reflects sites, not individual students. The first number is the number of sites in 1994–95; the second number is the number of sites in 1995–96. Sites could either mean districts or schools.

Reference Periods

This study has two parts. The first part focuses on 6th- and 7th-graders in 1994–95. The second part focuses on 8th-graders in 1995–96. Although predominantly the same sites participated, Ridgway et al. and Hoover et al. did not intend for the study to be longitudinal. However, some of the 8th-graders might also have been in the sample the previous year.

Baseline Data

Ridgway et al. and Hoover et al. do not report any baseline characteristics of the schools or students participating in the study other than the pretest scores of the students. Table 1 shows the students' scores on both the ITBS and BA tests taken in September. Ridgway et al. and Hoover et al. found pretest differences in both tests and in grades 6, 7, and 8.

Table 1. Pretest Mean Scores of the Study Sample[a]

Students	Pretest mean (grade equivalent) on math achievement: ITBS	
	Intervention group	Comparison group
Grade 6	6.1	7.1
Grade 7	7.4	7.9
Grade 8	8.2	7.7
Students	**Pretest mean (raw scores) on math achievement: BA**	
	Intervention group	**Comparison group**
Grade 6	11.7	13.2
Grade 7	14.5	12.3
Grade 8	17.7	11.6

[a]Sample sizes for the pretest scores reported here are the same as those reported for the posttest.

Statistical Methods

Ridgway et al. analyze the data using either analysis of variance (ANOVA) or analysis of covariance (ANCOVA). For the ITBS test, no covariate was used as a control in the analysis. For the BA test, Ridgway et al. use the September ITBS test scores to control for initial differences between the CMP and the non-CMP groups.

Outcomes and Estimation

The results were mixed depending on the test—the ITBS test or the BA test. On the ITBS test, Ridgway et al. and Hoover et al. found a statistically significant negative effect of the CMP in the 6th grade. Comparison group students' scores gained more than the CMP students. In the 7th and 8th grades, the results were nonsignificant.

For the BA assessment, there was a positive statistically significant effect in grades 6, 7, and 8, even after controlling for pretest differences. The CMP students gained differentially more than the non-CMP students.

Intervention Developer Contact Information

Contact the local Prentice Hall Sales Representative at the general number 1-800-848-9500; or contact CMP at 517-432-2820 or visit the website www.math.msu.edu/cmp/index.html.

Related Studies

See reports on other studies of Middle School Math curricula.

See reports on other studies of the Connected Mathematics Project.

Report Production

Date created: November 15, 2004

Topic area reviewed under: Curriculum-Based Interventions for Increasing K–12 Math Achievement—Middle School

WWC Study Ratings[a]: Ridgway et al. (2002) and Hoover et al. (1997)

Causal Validity: Meets WWC Standards with Reservations[a], a Quasi-Experimental Design with Matching

Participants in the intervention group and the comparison group were matched as much as possible on geographic location, student population diversity, and student ability grouping. There were significant differences between the groups on a pretest of the Iowa Test of Basic Skills (ITBS) and the Balanced Assessment (BA) test, but the authors controlled for the differences in the BA test using the ITBS pretest scores in the analysis. No attrition occurred at the school level, and no extraneous events were identified that appeared to confound the intervention's effect.

Other Study Characteristics	Study Rating	Study-Specific Information
Intervention Fidelity	●	The Connected Mathematics Project (CMP) intervention is well defined and replicable. It meets the definition for middle school math. However, the researchers do not provide further information about the implementation of the curriculum beyond its description.
Outcome Measures	●●	Two outcome measures are used in this study—the ITBS and the BA test. Both tests appear to be appropriately aligned and have acceptable reliability.
People, Settings, and Timing	●	Although Ridgway et al. and Hoover et al. report that they matched intervention and comparison groups on geographical location, student population diversity, and student ability grouping, they do not report on the variation of these characteristics in the sample. The outcome measures were administered in April, before the end of the school year.
Testing within Subgroups	●	The intervention's effect is tested across the entire sample but not within important subgroups.
Analysis	●	The results were analyzed at the student level and do not match the unit of intervention delivery, which is either at the school or classroom level.
Statistical Reporting	●	The statistical properties of the data do not allow for valid estimates of effect sizes due to the mismatch between the unit of assignment and the unit of analysis.

Note. ●● Fully meets criteria; ● Meets minimum criteria; **X** Does not meet criteria.

[a] For more information on the criteria used to rate this study, see the WWC Evidence Standards: Middle School Math.