# Intervention report: Connected Mathematics Project

Updated December 1, 2004

**Intervention**

The *Connected Mathematics Project* is a problem-centered mathematics curriculum designed to help students in grades 6 to 8 develop mathematical knowledge, understanding, and skills. It contains eight student units for each grade level and covers five content strands: number and operations, geometry, measurement, data analysis and probability, and algebra. Characterized by an inquiry mode, instruction is conducted in three phases: launch, explore, and summarize.

**For**

Middle school students.

**Findings**

Findings from the three quasi-experimental design studies were not statistically significant.

**Evidence base**

0 randomized controlled trials meet evidence standards.

3 quasi-experimental design studies meet evidence standards with reservations.

12 studies do not meet evidence screens.

*(see symbol key on page 10)*

**Evidence limits**

The WWC has reservations about all three studies. They are quasi-experimental design studies, which provide weaker evidence of effects because unmeasured differences between the groups can affect the findings. The three studies do not describe strong implementation of the intervention. One of the studies analyzed the data at the wrong level, which may bias the findings.

**Scope of use**

During its development between 1991 and 1997 the *Connected Mathematics Project* was pilot-tested by about 160 teachers and 45,000 students in diverse school settings across the United States. As of September 2004, it was implemented in 2,462 school districts, covering all 50 states.

**Developer and contact**

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## Profile

The *Connected Mathematics Project* is a complete middle school mathematics curriculum developed under the guidance of *Principles and Standards for School Mathematics* (National Council of Teachers of Mathematics 2000), according to the developers. Its purpose is to help students develop understanding of important concepts, skills, procedures, and ways of thinking and reasoning in five content strands: number and operations, geometry. measurement, data analysis and probability, and algebra. According to its developer, a key feature is that it is a problem-centered curriculum, which helps students learn important mathematics concepts and offers them opportunities for skills practice through engaging in-class problems and homework questions.

### Teaching

Consistent with the problem-centered curriculum is the inquiry model of instruction, which consists of three phases: launch, explore, and summarize.

In the first phase, the teacher launches the problem with the whole class, introduces new ideas, clarifies definitions, reviews old concepts, and connects the problem to past experiences of the students. In the explore phase, students work individually, in pairs or small groups, or occasionally as a whole class to solve the problem. In the summarize phase, students discuss their solutions as well as the strategies they used to approach the problem, organize the data, and find the solution.

Intended as a three-year mathematics curriculum, the *Connected Mathematics Project* covers grades 6 to 8, providing eight student units for each grade level. Each unit is organized around an important mathematical idea or cluster of related ideas, and is divided into several investigations, with each investigation containing a series of problems. The implementation plan is based on a 45–60 minute class period and a 180-day school year. The *Connected Mathematics Project* provides extensive teacher support through Teacher's Guides specifically designed for each student unit. But the Teacher's Guides and other supporting materials are not enough to ensure successful implementation of the curriculum. The developer suggests that when a district uses the curriculum for the first time, it should establish a support system for all the *Connected Mathematics Project* teachers in a building.

### Scope of use

Pilot editions were used between 1991 and 1997 by approximately 160 teachers and 45,000 students in diverse school settings across the United States. As of September 2004, it had been implemented in 2,462 school districts, covering all 50 states.

### Cost

According to Prentice Hall, the publisher, the *Connected Mathematics Project* costs $6.97 per student unit and $19.97 per teacher unit. See the publisher for costs for other resources.

## Study findings

### *Quasi-experimental design studies*

One study (500 students in 6th grade, 861 students in 7th grade, and 1,095 students in 8th grade) (Ridgeway and others 2002) had mixed findings. It found that students in 8th grade scored higher on the Iowa Test of Basic Skills (ITBS) and students in 6th through 8th grades scored higher on a locally developed test than did comparison students. However, this study also found that students in 6th and 7th grades scored lower on the ITBS than did comparison students. Due to limitations in the way these analyses were conducted—a mismatch between the unit of assignment and the unit of analysis—it is not possible to determine whether these findings are due to the curriculum or to chance. A second study of 50 schools (Riordan & Noyce 2001) found that 8th-grade students using the *Connected Mathematics Project* scored higher than comparison students using traditional texts on the Massachusetts Comprehensive Assessment System; this difference was not statistically significant. A third study with 42 schools in cohort 1, 38 schools in cohort 2, and 36 schools in cohort 3 (Schneider 2000) found that one group of students using the *Connected Mathematics Project* scored higher than comparison students on the Texas Assessment of Academic Skills, but two other groups of students using the *Connected Mathematics Project* scored lower than comparison students. Neither of these findings was statistically significant.

## Strength of the evidence base

The WWC collected more than 800 studies for the Middle School Math Curriculum review. Fifteen studies looked at the effects of the *Connected Mathematics Project*. Of these, three quasi-experimental design studies met WWC evidence standards with reservations. Twelve studies did not meet evidence screens. Ten of these were quasi-experimental design studies that did not account for pre-existing differences between groups with matching or equating. In the other two studies, there was only one intervention and one comparison participant, so the analysis could not separate the effects of the intervention from other factors.

Studies were rated according to the strength of their causal evidence. Studies that placed students into the intervention and comparison groups randomly (randomized controlled trials) without notable design or implementation flaws are classified as meeting evidence standards (✓✓[a]). Other studies that use comparison groups (quasi-experimental designs) and randomized control trials with notable flaws are classified as meeting evidence standards with reservations (✓[a]).

Studies are further rated for intervention fidelity, outcome measures, breadth of evidence, reporting on subgroups, analysis, and statistical reporting. That information is provided in study reports, but does not affect the overall rating.

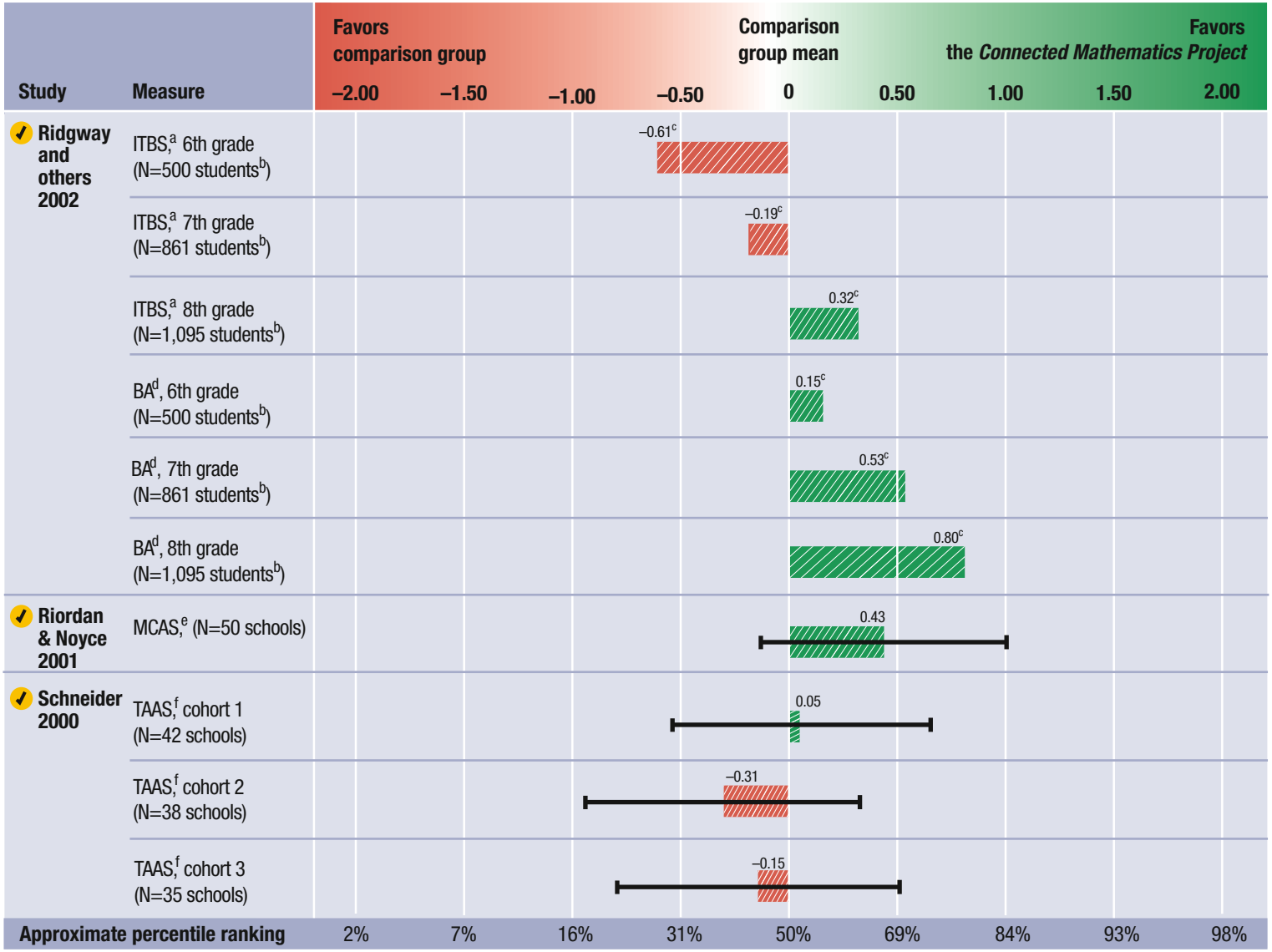
The three quasi-experimental design studies on the *Connected Mathematics Project* that meet WWC evidence standards with reservations either describe flaws with the implementation or do not fully describe the quality of implementation. The primary outcome measures for these studies appear to be valid and aligned with the curriculum. All three studies include at least one outcome measure that is a norm- or criterion-referenced standardized state test. Collectively, the studies looked at a variety of grade levels (6 through 8) of different backgrounds (high and low poverty levels) from different regions of the country (midwest, west, east, northeast, south) and settings (urban, rural, suburban). Although the studies provided data for analysis, some caution should be exercised when interpreting the outcomes of Ridgway and others, 2002, because the analysis was conducted at the wrong level.

Tables A2–A4 describe the three studies on the *Connected Mathematics Project* that meet WWC evidence standards with reservations. For a more detailed description of the studies, see the *Detailed Study Report* or *Brief Study Report* for each of the studies.

**a** See symbol key on page 9.

**Table 1**

## Effects




**a** Iowa Test of Basic Skills, a nationally normed, standardized test.
**b** Sample size reported is unit of analysis, not unit of assignment.
**c** When there is no solid line, the study did not provide data to correctly compute the confidence interval.
**d** Balanced Assessment Test, not a state or nationally normed, standardized test.
**e** Massachusetts Comprehensive Assessment System, a state normed, standardized test.
**f** Texas Assessment of Academic Skills, a state normed, standardized test.

**How to read this table:** The wide, shaded bar indicates both the direction and estimated size of the effect of the intervention. The estimated effects reported here are standardized differences in the mean values between the intervention and comparison groups. Bars extending to the right of zero denote estimated effects that favor the intervention group and those extending to the left of zero denote estimated effects that favor the comparison group. The solid line through the shaded bar marks the 95% confidence interval of the estimated effect. When the line does not cross zero (and the bar is solid, not striped), the estimate is statistically significant. The bar is striped if the effect is not significant or if significance could not be accurately computed. The scale at the bottom of the chart indicates the approximate percentile distribution of students in the control group. The percentile ranking at the end of the shaded bar can be used to interpret the standardized mean difference in the outcome. For example, an effect of .5 is roughly equivalent to an increase in the mean value from that of the average student in the comparison group (50th percentile) to that of the average student at the 69th percentile.

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# Appendix

**Table A1** **Summary characteristics and findings from quasi-experiemental design studies on the *Connected Mathematics Project***

| Study | Study sample | Measure | Sample size: Intervention group | Sample size: Comparison group | Sample size: Total | Mean outcome: Intervention group | Mean outcome: Comparison group | Standard deviation[a]: Intervention group | Standard deviation[a]: Comparison group | Estimated impact[b]: Mean difference | Estimated impact[b]: Standardized mean difference |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ridgway, Zawojewskj Hoover, & Lambdin 2002** | 6th grade students | ITBS[d] | 338 | 162 | 500 students[e] | 7.1 | 8.6 | 2.3 | 2.7 | –1.5 | –0.61[c] |
| | 7th grade students | | 627 | 234 | 861 students[e] | 8.6 | 9.1 | 2.6 | 2.9 | –0.5 | –0.19[c] |
| | 8th grade students | | 820 | 275 | 1,095 students[e] | 9.4 | 8.6 | 2.5 | 2.6 | 0.8 | 0.32[c] |
| | 6th grade students | Balanced Assessment Test[f] | 338 | 162 | 500 students[e] | 20.0 | 18.1 | 12.6 | 11.9 | 1.9 | 0.15[c] |
| | 7th grade students | | 627 | 234 | 861 students[e] | 21.4 | 15.4 | 11.6 | 10.3 | 6.0 | 0.53[c] |
| | 8th grade students | | 820 | 275 | 1,095 students[e] | 27.0 | 16.3 | 14.0 | 11.2 | 10.7 | 0.80[c] |
| **Riordan & Noyce 2001** | 8th grade regular education students | MCAS[g] | 30 | 20 | 50 schools | 238.2 | 233.9 | 9.1 | 10.3 | 4.6 | 0.43 (±0.57) |
| **Schneider 2000[h]** | Group 1 | TAAS[i] | 19 | 23 | 42 schools | 73.2 | 72.9 | 6.37 | 5.46 | 0.3 | 0.05 (±0.61) |
| | Group 2 | | 19 | 19 | 38 schools | 72.3 | 74.2 | 6.59 | 5.29 | –1.9 | –0.31 (±0.64) |
| | Group 3 | | 18 | 18 | 36 schools | 73.6 | 74.5 | 5.41 | 6.37 | –0.9 | –0.15 (±0.65) |

**a** Shows how dispersed the participants' outcomes are. A small standard deviation would suggest that participants had similar outcomes.
**b** The WWC estimated impacts based on statistics reported by the study author.
**c** The unit of analysis (students) did not match the unit of assignment. For that reason, accurate confidence intervals could not be computed.
**d** Iowa Test of Basic Skills, a nationally normed, standardized test.
**e** The sample size reported is unit of analysis, not unit of assignment.
**f** This is not a state or nationally normed standardized test, but it meets the WWC screen of having face validity (based on a sample or description of items) or minimum reliability.
**g** Massachusetts Comprehensive Assessment System, a criterion-referenced state test.
**h** The sample of this study included three cohorts. Group 1 students had the curriculum at grades 6–8 from 1996/97 to 1998/99; Group 2 students had the curriculum at grades 6 and 7 from 1997/98 to 1998/99; and Group 3 students had the curriculum at grade 6 during 1998/99.
**i** Texas Assessment of Academic Skills, a state-normed, standardized test.

**Table A2**

## Characteristics of interventions in reviewed studies on the *Connected Mathematics Project:* Ridgway, Zawojewski, Hoover, & Lambdin 2002

| Evidence base rating[a] | Characteristic | Description |
|---|---|---|
| ✓ | Study citation | 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 they are? What do students learn?* Mahwah, NJ: Eribaum. |
| | Participants | The 1994/95 sample included 338 6th-graders and 627 7th-graders from 9 *Connected Mathematics Project* schools (2 classrooms per grade from each school), and 162 6th-graders and 234 7th-graders from 9 comparison schools (1 classroom per grade from each school). The 1995/96 sample included 820 8th-graders from an unspecified number of *Connected Mathematics Project* schools and 275 8th-graders from an unspecified number of comparison schools. Some students were included in both the 1994/95 sample and the 1995/96 sample. Demographic characteristics of the participants are not reported. |
| | Setting | Participating classrooms were from schools located in the Midwest, West, and East regions of the country. |
| | Intervention | Teachers in the intervention group were using the *Connected Mathematics Project* as the core curriculum throughout the school year. The study authors do not report, however, how the *Connected Mathematics Project* was actually implemented in those classrooms. Student participants received varied amount of intervention. All the 6th-grade students in the study were new to the *Connected Mathematics Project,* and about three-fourths of the 7th- and 8th-grade students in the study had used the *Connected Mathematics Project* in the previous year. |
| | Comparison | Teachers in the comparison group did not implement the *Connected Mathematics Project,* nor were they involved in any reform efforts. Data were not available about the mathematics textbook series used by those teachers. |
| | Primary outcomes and measurement | Iowa Test of Basic Skills (ITBS) Survey Battery and Balanced Assessment (BA) Test. ITBS is a norm-referenced standardized test. BA is a test designed to assess students' math achievement in a variety of curricular areas through constructed-response items. It was developed through the collaboration between the *Connected Mathematics Project* developer and the Balanced Assessment Project. |
| | Teacher training | All *Connected Mathematics Project* teachers attended the summer *Connected Mathematics Project* institutes at Michigan State University. |

a See symbol key on page 9.

**Table A4**

## Characteristics of interventions in reviewed studies on the *Connected Mathematics Project:* Riordan & Noyce 2001

| Evidence base rating[a] | Characteristic | Description |
|---|---|---|
| ✓ | Study citation | Riordan, J. & Noyce, P. (2001). The impact of two standards-based mathematics curricula on student achievement in Massachusetts. *Journal for Research in Mathematics Education, 32* (4), 368–398. |
| | Participants | 20 *Connected Mathematics Project* schools with 1,879 8th-graders and 30 matched comparison schools with 4,978 8th-graders. Overall, 10% of the student participants were eligible for free or reduced-price lunches, and 87% of the students were white. All students were regular education students. |
| | Setting | Relatively advantaged middle schools with predominantly white students and a low percentage of students receiving free or reduced-price lunches in Massachusetts. |
| | Intervention | Schools in the intervention group had implemented at least 11 student units in grades 6 through 8 by 1998/99, but none of the schools implemented all the eight units that the *Connected Mathematics Project* has available for each grade. Further, it is not clear how the *Connected Mathematics Project* was actually implemented in those schools. Twenty schools in the intervention group had implemented the *Connected Mathematics Project* for two to three years, and one school had implemented the program for four years. |
| | Comparison | The 30 comparison schools did not implement the *Connected Mathematics Project,* but used 15 different textbook programs, which, in the aggregate, represented the instructional norm in Massachusetts. The most commonly used programs were those published by Heath, Addison-Wesley, Prentice Hall, and Houghton-Mifflin. |
| | Primary outcomes and measurement | Massachusetts Comprehensive Assessment System, a criterion-referenced state test that includes both multiple-choice and open-response questions. |
| | Teacher training | No teacher training reported. |

**a** See symbol key on page 9.

**Table A5** **Characteristics of interventions in reviewed studies on the *Connected Mathematics Project:* Schneider 2000**

| Evidence base rating | Characteristic | Description |
|---|---|---|
| ✓ | Study citation | Schneider, C.L. (2000). Connected Mathematics and the Texas Assessment of Academic Skills. *Dissertation Abstracts International*, 62(02), 503. (UMI No. 3004374) |
| | Participants | 23 *Connected Mathematics Project* schools and 25 matched comparison schools overall, including three smaller cohorts. Cohort 1 had 23 intervention and 19 comparison schools. Cohort 2 had 22 intervention and 19 comparison schools. Cohort 3 had 18 intervention and 18 comparison schools. Those schools varied in the racial composition, socio-economic status, special education status, and English language learner status of the student populations that they served. Many of the schools had predominantly minority student populations. |
| | Setting | Schools in rural, suburban, and urban, and both low and high socio-economic areas of Texas. |
| | Intervention | Schools in the intervention group were using the *Connected Mathematics Project* for grades 6 through 8. There were substantial variations in the extent to which the curriculum was used at each grade and each year across these schools. The three cohorts in the intervention group received *The Connected Mathematics Project* for three years, two years, and one year respectively between 1996/97 and 1998/99. |
| | Comparison | The 25 comparison schools did not implement the *Connected Mathematics Project,* and it is unclear what mathematics curricula they were using. |
| | Primary outcomes and measurement | Texas Assessment of Academic Skills (TAAS) passing rate and Texas Learning Index (TLI). TAAS is a criterion-referenced state test that measures problem-solving and critical-thinking skills. TLI is a TAAS-based statistic designed for comparing student progress between administrations and between grades. |
| | Teacher training | Teachers who taught grade 6, 7, or 8 at the 23 *Connected Mathematics Project* schools participated in a six-day summer professional development conducted by the Texas Statewide Systemic Initiative in 1996, 1997, and 1998. |

**Symbol key for evidence base rating**

✓✓ Study meets evidence standards (randomized controlled trial without notable flaws).

✓ Study meets evidence standards with reservations (randomized controlled trial with notable flaws or quasi-experimental design study without notable flaws).

✗ Study does not meet evidence screens.