

# What Works Clearinghouse

Brief Study Report



**Reviewed Study:** **Baker, J. J. (1997). *Effects of a generative instructional design strategy on learning mathematics and on attitudes towards achievement*. Unpublished doctoral dissertation, University of Minnesota.**

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 extend the results of the individual studies.

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

**Intervention:** The Expert Mathematician

**Study Design:** Randomized Controlled Trial

**Study Rating:**

**Date Released:** June 30, 2004



= Meets Evidence Standards



= Meets Evidence Standards with Reservations



= Does Not Meet Evidence Standards

## What Is this Report About?

The Expert Mathematician (version 3.0), a [middle school math curriculum](#), was developed from LogoWriter, a computer program that the developer claims is designed to help children learn independently through exploration. According to J. J. Baker, the Expert Mathematician is designed to provide a creative environment that is intended to foster a child's

higher learning skills. It contains 196 lessons. This WWC Study Report reviews a study that compares the effects of The Expert Mathematician with those of a more traditional, teacher-directed curriculum (Baker, 1997). This WWC report summarizes the study and reviews its strengths and weaknesses. A more detailed, technical version of this study report is available [here](#) (PDF).

**The What Works Clearinghouse** ([www.whatworks.ed.gov](http://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](mailto: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](#).

## How Was the Study Conducted?

The study participants were 8th-grade students from a suburban middle school in St. Louis, Missouri. Most of the students were from low-income families and qualified for free or reduced-priced lunch. All but three of the students were white. The students varied in their ability; none were in special education.

At the beginning of the study, 90 students were randomly divided by a computer algorithm into either the intervention or control group. The students were then divided randomly again, through a flip of a coin, into classes. There were two intervention classes and two control classes. Each class had about 23 students.

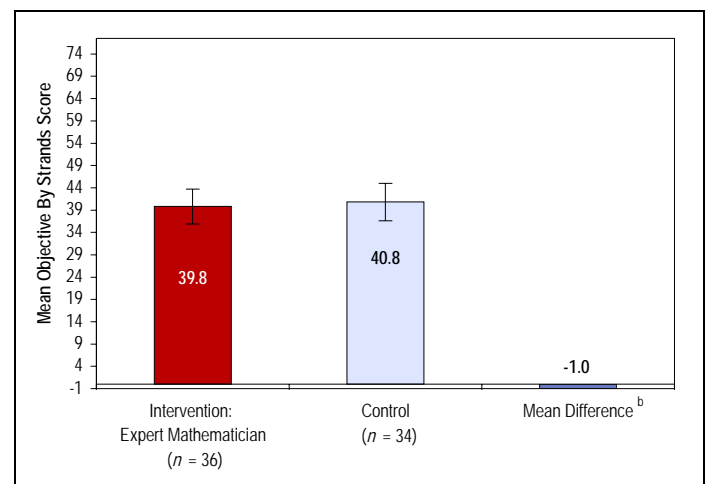
In the Expert Mathematician (intervention) class, students worked individually or in pairs using the printed materials and the computer to learn a new procedure in order to solve a math problem. Classes were conducted every other day for one school year. Sessions were 85 minutes long and included one to two math lessons.

The outcome measure relevant to this WWC report was the Objectives by Strands test (sometimes referred to as “Mathematical Concepts and Applications Survey” by the author), which was used to measure the students’ mathematics achievement before and after the intervention. As reported by Baker, the test was developed by a large urban school district, and it contained 78 multiple-choice items.

## What Did the Study Find?

In one of several analyses, Baker (1997) found that there was no significant difference in gain scores between students in the Expert Mathematician and the control groups when controlling on pretest. (See Figure 1.) However, Baker (1997) did report that the average gain scores of the students in the Expert Mathematician classes were similar to the gain scores of students in the control group on the Objectives by Strands test. In this study, natural student groupings (classrooms, schools, etc.) may have affected findings. Although the author’s analysis does not address this grouping problem, the author does not report significant positive findings, so the impact of groupings on findings is likely minimal.

Figure 1. Impact Reported by Baker<sup>a</sup>



<sup>a</sup> Confidence intervals were computed by the WWC.

<sup>b</sup> The intervention group scores were not significantly lower than the control group scores ( $p \leq .05$ ).

WWC Study Ratings<sup>a</sup>  
Baker (1997)

**Causal Validity: Meets WWC Evidence Standards, a Randomized Controlled Trial with No Randomization, Attrition, or Disruption Problems**

Participants were randomly assigned to the intervention and control groups. There was a significant difference between groups on the Objective by Strands pretest scores; but this was addressed by the study author. There was severe overall attrition, but it did not affect the initial equivalence of the groups analyzed. Other than the pretest, no extraneous events were identified that appeared to be confounded with the intervention’s effect.

**Other Study**

<b>Characteristics</b>	<b>Study Rating</b>	<b>Study-Specific Information</b>
Intervention Fidelity	●●	The intervention is well defined and implemented and meets the definition of Middle-School Math.
Outcome Measures	●●	The test appeared to be appropriately aligned with the intervention. The reliability calculations are based on 62 survey items, although it was reported that the survey contained 78 items; however, this was not a significant issue.
People, Settings, and Timing	●	The number of participants and settings was too small and homogeneous to allow generalization to the full range of people and settings that are the target of Middle-School Math interventions. The Objectives by Strands test was administered at the beginning and at the end of the study.
Testing within Subgroups	●	The intervention effect was tested across the entire sample but not within important variations in settings.
Analysis	●	The results were analyzed at the level of individual students, which matches the unit of randomization. In this study, natural student groupings (classrooms, schools, etc.) may have affected findings. Although the authors’ analysis did not address this grouping problem, the author does not report significant positive findings, so the impact of groupings on findings is likely minimal. The sample size was too small to allow for a precise estimate of effect.
Statistical Reporting	●●	The author reports unadjusted means and standard deviations of the outcome measure, Objectives by Strands test, as well as the sample sizes for both the intervention and control groups, so an estimate of its effect could be calculated.

**Summary of Results**

There was no statistically significant difference in student performance between students receiving the Expert Mathematician curriculum and those in the control groups. Baker reported negligible differences between the Expert Mathematician intervention and control groups. The outcome measure is sufficiently reliable, based on the author’s report of its reliability, but the sample size was relatively small. In addition, the sampled participants and settings were restricted.

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

<sup>a</sup> For more information on the criteria used to rate this study, see the [WWC Study Review Standards](#).

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## How Can You Find Out More?

- To learn more about this study, read the [detailed report](#) (PDF) or the [original study](#) (PDF).
- **To see reports on [other studies of Middle school Math curriculum](#).**
- **Cost information:** not available.
- **Intervention developer contact information:**

The Expert Mathematician at:  
[www.expertmath.org](http://www.expertmath.org);  
email: [frstprin@mninter.net](mailto:frstprin@mninter.net);  
telephone: (612) 872-6741.

## *Report Production*

**Date created:** June 30, 2004

- The study was reviewed under the first of three waves (middle, elementary, and high school) under the topic—Curriculum-Based Interventions for Increasing K–12 Math Achievement.