



What Works in Teaching Math

Robert Slavin

*For better outcomes, focus on the classroom, not just the curriculum, writes **Robert Slavin**.*

If students are to reach their full potential, they must be able to confidently compute and solve complex math problems. To ensure success in math for all children, educators need to know which programs and practices are effective. Which textbooks, computer programs, and professional development strategies increase math achievement?

We carried out a review of research on math programs in both elementary and middle/high schools. The aim was to place all types of programs on a common scale. In this way, we hoped to provide educators with meaningful, unbiased information that they can use to choose programs and practices. We examined the quantitative evidence on math programs to discover how much of a scientific basis there is for competing claims about their effects.

Our review threw some interesting light on the kinds of math reforms that are likely to improve the achievement of children in math.

Studies We Included

In order to be included in our review, studies had to meet a number of commonsense criteria:

- Students participating in a program had to be compared to children using ordinary methods.
- Students participating in a program had to be well matched to those using ordinary methods.

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- Measures had to be fair to all groups (and not, for example, be a test inherent to the program).
- Programs had to be evaluated for at least twelve weeks—and preferably a year or more.

We considered studies carried out in all countries, but the results had to be available in English. The majority of studies were done in the United States. In total, nearly 200 studies met the inclusion criteria for the two reviews. They broke down into three broad areas—math curricula, computer-assisted instruction (CAI) approaches, and teaching strategies.

Math Curricula

A number of studies measured impact on achievement for various textbooks and curricular innovations. These fell into three categories:

- Innovative strategies that focus on problem solving, alternative solutions, and conceptual understanding
- Traditional commercial textbooks
- A back-to-basics textbook that emphasizes a step-by-step approach

There were thirteen studies of elementary curricula and forty of middle/high school curricula. There was very little evidence that it mattered which curriculum was used. None of them showed any strong evidence of effectiveness in comparison to the others. Although it might be suggested that the standardized tests used to measure performance would not detect some of the more sophisticated skills taught by some innovative curricula, there didn't seem to be any evidence of this in the studies we looked at.

Computer-Assisted Instruction Approaches

In elementary schools, technology has typically been used as a supplement to classroom teaching—often used only a few times a week. These programs can help to identify children's strengths and weaknesses and then give them self-instructional exercises designed to fill in gaps.

Across the thirty-eight elementary school studies that qualified for our review, we found that most studies found positive effects, and none significantly favored a control group. However, there was not enough high-quality evidence to recommend one program over another. We also found that the outcomes were stronger for computations than for concepts or problem solving. This is not surprising, as CAI particularly helps children with their computation skills. In middle/high schools, technology is used in three ways in the teaching of math:

- Supplemental programs, used to fill gaps in children's knowledge
- Core programs, where the computer largely replaces the teacher

- Computer-managed learning systems that use a computer to assess students and provide teachers with feedback for use in lessons. In the forty qualifying studies that looked at these various programs, there was little evidence of effectiveness. No program stood out as having large and replicated effects.

Teaching Strategies

A number of studies have looked at the impact of using extensive professional development to help teachers use effective teaching strategies. These studies usually keep the textbooks, content, and objectives the same but change the teaching methods.

There were thirty-six qualifying studies of professional development strategies in elementary schools and twenty-two in middle/ high schools. Professional development programs had the strongest evidence of effectiveness. Cooperative learning was particularly strong. In cooperative learning, students work in pairs or small groups to help each other. This strategy increases learning if the groups have a common goal that they can only achieve if all group members do well on independent learning. In other words, students have to teach each other, because their own success depends on it.

In elementary schools, programs that focused on classroom management and motivation also had strong evidence of effectiveness.

Conclusion

There are a number of important conclusions to be taken from our reviews:

- There is no evidence that different curricula give different achievement outcomes. Clearly this has enormous implications for teaching and policy.
- There is also limited evidence that ordinary CAI improves math learning.
- Finally, there is strong evidence that using effective teaching strategies can make a real difference. Changing the way that children work together, and classroom management and motivation, can improve the math outcomes for all students.

The full reviews, together with educator's summaries, can be found on the Best Evidence Encyclopedia (BEE) website: www.bestevidence.org.

About the Author

Robert Slavin is director of the Center for Research and Reform in Education at Johns Hopkins University and a professor in the Institute for Effective Education at the University of York in the United Kingdom. He is also chairman of the Success for All Foundation, a restructuring program that helps schools to identify and implement strategies to meet the needs of all learners.

References and Further Reading

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