What Works Clearinghouse

ies INSTITUTE OF EDUCATION SCIENCES

Early Childhood Education July 23, 2007

SRA Real Math Building Blocks PreK

Program description[1]

SRA Real Math Building Blocks PreK (also referred to as *Building Blocks for Math*) is a supplemental mathematics curriculum designed to develop preschool children's early mathematical knowledge through various individual and small- and large-group activities. It uses *Building Blocks for Math PreK* software, manipulatives, and print material. *Building Blocks for Math* embeds mathematical learning in children's daily activities, ranging from designated math activities to circle and story time, with the goal of helping children relate their informal math knowledge to more formal mathematical concepts.

Research

Two studies of *Building Blocks for Math* met the What Works Clearinghouse (WWC) evidence standards.[2] They included over 250 preschool children from New York State. This report focuses on immediate posttest findings to determine the effectiveness of the intervention.[3] The WWC considers the extent of evidence for *Building Blocks for Math* to be small for mathematics achievement. No studies that met WWC evidence standards with or without reservations addressed oral language, print knowledge, phonological processing, early reading/writing, or cognition.

Effectiveness

Building Blocks for Math was found to have positive effects on mathematics achievement.

	Oral language	*Print knowledge*	*Phonological processing*	*Early reading/ writing*	*Cognition*	*Math*
Rating of effectiveness	na	na	na	na	na	Positive Effects
Improvement index[4]	na	na	na	na	na	Average: +36 percentile points Range: +27 to +42 percentile points

na = not applicable

1. The descriptive information for this program was obtained from publicly available sources: the research literature (Clements & Sarama, 2006, June; Clements & Sarama, 2007; Clements & Sarama, 2002; Clements & Sarama, n.d.; Sarama & Clements, 2003), and the program description provided by the author upon the WWC request. The WWC requests developers to review the program description sections for accuracy from their perspective. Further verification of the accuracy of the descriptive information for this program is beyond the scope of this review.
2. To be eligible for the WWC's review, the Early Childhood Education (ECE) intervention had to be implemented in English in center-based settings with children aged three to five or in preschool.
3. The evidence presented in this report is based on available research. Findings and conclusions may change as new research becomes available.
4. These numbers show the average and range of student-level improvement indices for all findings across the studies.

Additional program information[1]

Developer and contact

Building Blocks for Math was developed by Drs. Douglas Clements and Julie Sarama and is available for preview by contacting the developers. Address: Graduate School of Education, University at Buffalo, The State University of New York, Buffalo, NY 14260. Email: clements@buffalo.edu or jsarama@buffalo.edu. Web: http://www.gse.buffalo.edu/org/buildingblocks/. Telephone: (716) 645-2455 Ext. 1155. It is distributed by SRA/McGraw-Hill; contact Rick Rikhoff, Director of Marketing Services. Email: rick_rikhoff@mcgraw-hill.com. Telephone: (614) 750-7264.

Scope of use

A year after the curriculum was released in 2006, there were 23,000 children in 51 schools across the nation who purchased *Building Blocks for Math*. In several documented research projects, *Building Blocks for Math* has been implemented by additional preschool and childcare programs in New York (more than 100 classrooms), Massachusetts (more than 60 classrooms), and Nashville (more than 50 classrooms). These programs include children from low- and mixed-income families.

Teaching

The *Building Blocks for Math* materials integrate three types of media: software, manipulatives (and everyday objects), and print materials (e.g., books). The materials are designed to be used in a variety of environments: home, day care, and classroom. *Building Blocks for Math* integrates computer activities *(DLM Express)* with other activities like teaching games and free-choice learning centers. The curriculum is structured around empirically based learning trajectories (i.e., what is appropriate for children at that age in terms of mathematics). The curriculum includes whole- and small-group activities and games, free-choice learning centers, ideas for integrating mathematics throughout the school day, computer software, and books, game sheets, and manipulatives. Activities are designed so they are based on children's experiences and interests because the program aims to "mathematize" their everyday activities, including building blocks, art, songs, stories, and puzzles. The software includes 150 activities (60 are intended for preschoolers). The *Building Blocks for Math* materials emphasize mathematical actions-on-objects, such as solving a sequence of geometric puzzles by filling outlines with pattern blocks.

Teaching guidance is provided for both off- and on-computer activities in the teachers' materials. The software's management system presents tasks, contingent on success along research-based trajectories that are sequenced according to children's developmental progression.

Cost

Costs for curriculum materials, teacher resources, and software are:

- Real Math Teacher Edition, Pre-K costs $198
- Real Math Teacher Resource Book, Pre-K costs $129
- Real Math Assessment Booklet, Pre-K costs $78
- Real Math Pre-K Big Books (*The Shape of Things, I Spy Two Eyes, The Right Number of Elephants,* and *Bat Jamboree*) each cost $58
- Real Math Pre-K Manipulative Kit costs $282
- SRA Math *Building Blocks for Math* online costs $10 per student per year

Research

Three studies reviewed by the WWC investigated the effects of *Building Blocks for Math* in center-based settings. Two studies (Clements & Sarama, 2006; Clements & Sarama, 2007) were randomized controlled trials that met WWC evidence standards. The remaining study did not meet WWC evidence screens.

Clements and Sarama (2006) included 28 preschool teachers (202 children) from low- to mixed-income families in New York State and compared math outcomes for children participating in a *Building Blocks for Math* intervention group to a business-as-usual comparison group.[5]

Clements and Sarama (2007) included four preschool teachers (53 children) from low-income families in New York State and compared math outcomes for children who participated in a *Building Blocks for Math* group to a business-as-usual comparison group.

Extent of evidence

The WWC categorizes the extent of evidence in each domain as small or moderate to large (see the What Works Clearinghouse Extent of Evidence Categorization Scheme). The extent of evidence takes into account the number of studies and the total sample size across the studies that met WWC evidence standards with or without reservations.[6]

The WWC considers the extent of evidence for *Building Blocks for Math* to be small for mathematics achievement. No studies that met WWC evidence standards with or without reservations addressed oral language, print knowledge, phonological processing, early reading/writing, or cognition.

Effectiveness

Findings

The WWC review of interventions for early childhood education addresses children's outcomes in six domains: oral language, print knowledge, phonological processing, early reading/writing, cognition, and math. Clements and Sarama (2006, 2007) addressed outcomes in the math domain. The findings below present the authors' and the WWC-calculated estimates of the size and statistical significance of the effects of *Building Blocks for Math* on children's performance.[7]

Math. Clements and Sarama (2006) analyzed group differences between the *Building Blocks for Math* intervention group and the business-as-usual comparison group on one math outcome measure (Early Mathematics Assessment). The difference between groups was statistically significant and favored children in the *Building Blocks for Math* group.

Clements and Sarama (2007) found a statistically significant difference favoring children in the *Building Blocks for Math* group on one of the two outcome measures assessed in this domain (Building Blocks Assessment of Early Mathematics, PreK–K: Geometry section) and this effect was confirmed to be statistically significant by the WWC. The authors also reported statistically significant differences between the intervention and business-as-usual comparison groups on the other math measure (Building Blocks Assessment of Early Mathematics, PreK–K:

5. The study also included a *Pre-K Mathematics* intervention group, which used *DLM Express* as an additional component. The study authors labeled the *Pre-K Mathematics* group as the "comparison group" and the *Building Blocks for Math* group as the "intervention group"; however, the WWC considers *Pre-K Mathematics* as a separate intervention (see the separate WWC Pre-K Mathematics intervention report). For the rating of effectiveness in this WWC intervention report, the WWC includes only the results comparing the *Building Blocks for Math* group to the business-as-usual comparison group; however, results for the comparison between the curricula are included in a separate section of this report and in Appendix A4.
6. The Extent of Evidence Categorization was developed to tell readers how much evidence was used to determine the intervention rating, focusing on the number and size of studies. Additional factors associated with a related concept, external validity, such as the students' demographics and the types of settings in which studies took place, are not taken into account for the categorization.
7. The level of statistical significance was reported by the study authors or, where necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For an explanation, see the WWC Tutorial on Mismatch. See the Technical Details of WWC-Conducted Computations for the formulas the WWC used to calculate the statistical significance. In the case of *Building Blocks for Math,* corrections for clustering and multiple comparisons were needed.

Effectiveness *(continued)*

Number section); however, the WWC was unable to confirm the statistical significance of this effect.

Rating of effectiveness

The WWC rates the effects of an intervention in a given outcome domain as positive, potentially positive, mixed, no discernible effects, potentially negative, or negative. The rating of effectiveness takes into account four factors: the quality of the research design, the statistical significance of the findings,[7] the size of the difference between participants in the intervention and the comparison conditions, and the consistency in findings across studies (see the WWC Intervention Rating Scheme).

The WWC found *Building Blocks for Math* to have positive effects on math

Improvement index

The WWC computes an improvement index for each individual finding. In addition, within each outcome domain, the WWC computes an average improvement index for each study and an average improvement index across studies (see Technical Details of WWC-Conducted Computations). The improvement index represents the difference between the percentile rank of the average student in the intervention condition versus the percentile rank of the average student in the comparison condition. Unlike the rating of effectiveness, the improvement index is based entirely on the size of the effect, regardless of the statistical significance of the effect, the study design, or the analyses. The improvement index can take on values between –50 and +50, with positive numbers denoting results favorable to the intervention group.

The average improvement index for math is +36 percentile points across the two studies, with a range of +27 to +42 percentile points across findings.

Findings for comparisons between *Building Blocks for Math* and *Pre-K Mathematics*

The analysis for the comparison described below was included in the Clements and Sarama (2006) study, but the findings do not contribute to the overall rating of effectiveness because the WWC used the comparison of *Building Blocks for Math* to the business-as-usual comparison group from the same study in the rating, which provides a clearer sense of *Building Blocks for Math's* effects. However, the WWC believes that the findings from this comparison provide useful information to practitioners who may be interested in comparing the effects of different curricula. The WWC reports the findings for comparisons of *Building Blocks for Math* and *Pre-K Mathematics* here and in Appendix A4.

Math. Clements and Sarama (2006) analyzed group differences between the *Building Blocks for Math* group and the *Pre-K Mathematics* combined with *DLM Express* group for one math outcome measure (Early Mathematics Assessment). The difference between groups was statistically significant and favored children in the *Building Blocks for Math* group. The improvement index for math is +19 percentile points (*Building Blocks for Math* is the intervention group and *Pre-K Mathematics* is the comparison group) for the single finding in the study.

Summary

The WWC reviewed three studies on *Building Blocks for Math*. Two of these studies met WWC evidence standards; the remaining study did not meet WWC evidence screens. Based on these two studies, the WWC found positive effects for math. Additional findings that were not considered for the rating of effectiveness indicated that *Building Blocks for Math* may have a larger impact on children's math outcomes than another skills-focused preschool mathematics intervention. The evidence presented in this report may change as new research emerges.

References

Met WWC evidence standards

Clements, D. H., & Sarama, J. (2006, June). *Scaling up the implementation of a pre-Kindergarten mathematics curriculum: The Building Blocks curriculum.* Paper presented at the Institute of Education Sciences Research Conference, Washington, D.C.

Clements, D. H., & Sarama, J. (2007). Effects of a preschool mathematics curriculum: Summative research on the Building Blocks project. *Journal for Research in Mathematics Education, 38*(2), 136–163.

Additional sources:

Clements, D. H., & Sarama, J. (2002). *Effects of a preschool mathematics curriculum: Research on the NSF-funded Building Blocks Project.* University at Buffalo, State University of New York.

Clements, D. H., & Sarama, J. (n.d.). *Effects of a preschool mathematics curriculum: Summary research on the NSF-funded Building Blocks project.* University at Buffalo, State University of New York. Retrieved from http://www.gse.buffalo.edu/org/buildingblocks/writings/Building%20Blocks%20Research%201.pdf

Did not meet WWC evidence screens

Sarama, J., & Clements, D. H. (2003). Building Blocks of early childhood mathematics. *Teaching Children Mathematics, 9*(8), 480-484.[8]

For more information about specific studies and WWC calculations, please see the WWC *Building Blocks for Math* Technical Appendices.

8. The study did not use a comparison group.