IDB Education

BRIEFLY NOTED

No. 9 • JUNE 2011

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# LESS TALK, MORE PLAY: BOLSTERING MATH LEARNING IN ARGENTINA

**Summary:** Argentina and the Inter-American Development Bank (IDB) joined forces to test a new math education model called Mathematics for All (MAT). After just one academic year, learning increased in schools using the model, with particularly dramatic improvements among underperforming students. This brief describes how MAT improved learning by focusing on the development of mathematical thinking rather than on the memorization of formulas.


## Limited Evidence on What Works in Math

There is little evidence about what works in mathematics education in Latin America and the Caribbean (Valverde and Näslund-Hadley 2010). In an effort to identify an evidence-based math approach, Argentina's National Ministry of Education and the IDB collaborated on the implementation of a pilot project to generate knowledge about what works in the delivery of math education at the primary level. The pilot tested the effectiveness of an innovative inquiry-based math model.

## Teaching through Play

**MAT is a play-based pedagogical approach that aims to give meaning to mathematics and promote students' understanding of math concepts.** Rather than teaching students to simply repeat procedures by plugging numbers into formulas, MAT focuses on developing mathematical thinking and on helping students understand what they can do with their knowledge. The model builds on children's natural proclivity to play, tying educational content to the rules of games, such as lotteries, bingo, card games, addition and multiplication grids, and money counting. Students are encouraged to develop their own problem-solving strategies, justify their ideas, and accept suggestions and criticism from their peers.

Edited by Steven B. Kennedy • Design and layout by Laura C. Johnson

### Table 1. Students' Pre-Test Level Was Low

| Selected competencies | Proportion of students with capability at start of the program (%) |
|---|---|
| Division: estimate of quotient | 6.9 |
| Multiplication by ten | 17.6 |
| Perimeter of rectangle | 8.2 |
| Analyzing representations: addition of coins and bills | 27.8 |
| Comprehension of decimal numbers | 9.6 |

*Source:* Based on data from IIPE-UCUDAL 2010.

**To help bridge important gaps in their own knowledge, both substantive and pedagogical, the teachers also receive biweekly tutoring sessions in addition to traditional training.** The didactic materials used in MAT are simple; most of the investment required for the pilot is in teacher training and tutoring.

## Evaluating Mathematics for All

**The MAT pilot covered a population of approximately 9,000 fourth-grade students in more than 300 schools in the provinces of Tucumán and Buenos Aires.** The two areas were selected based on their socioeconomic characteristics and educational results. Both areas contain a high proportion of vulnerable schools and households with unmet basic needs, as well as of students who scored poorly in math on Argentina's national grade-level assessment test, the ONE. Because pre- and post-tests could not be administered to the entire pilot population, an evaluation sample was formed from 28 randomly selected schools, half of which were assigned to a control group. The number of fourth-grade students in the sampled schools exceeded 2,700. The sample groups were compared along many dimensions and were found to be fairly similar on average. The evaluation also encompassed a rigorous qualitative assessment of teaching practices and of teachers' perceptions and attitudes. For the qualitative evaluation, nonprobabilistic subsamples were drawn. The evaluation was conducted by a team of specialists from the Catholic University of Uruguay (UCUDAL) and the International Institute for Educational Planning (IIPE). This brief is based on the findings of the evaluation reported by IIPE-UCUDAL (2010).

## Low Initial Learning Levels

**Pre-test scores showed that across both provinces children had poor math skills.** Table 1 describes the proportion of students who could respond correctly to selected test items. Less than a third of the students could add two bills and four coins. Less than a fifth could multiply a number by ten. Only eight percent could calculate the perimeter of a rectangle. Only one in ten understood the concept of a decimal number.

## After MAT: Improved Perceptions of Students among Teachers

**The qualitative evaluation indicated that half of the participating teachers improved their perception of students, including children's capacity to reason, their interest in learning, and their ability to work in groups.** About half the teachers also improved their understanding of learning processes and the need for knowledge to be constructed together with the students, rather than simply transmitted from the teacher. In spite of this improvement, at the end of the year almost a quarter of the teachers maintained their outdated perceptions about learning processes and students' ability to learn. No changes were found in teachers' perceptions about math as a discipline, or in teachers' self-image.

## Table 2. The MAT Model Substantially Improved Learning (standardized test score points)

| Groups | | Increase in student test scores | Change due to MAT |
|---|---|---|---|
| Buenos Aires | MAT | 65 | 34 |
| | Regular | 31 | |
| Tucumán | MAT | 33 | 8 |
| | Regular | 25 | |
| Total | MAT | 44 | 19 |
| | Regular | 25 | |

*Source:* IIPE-UCUDAL 2010

## Substantially Improved Learning among Students

**Scores on the post-test show that in both provinces the program improved overall math learning.** After only one academic year, the group that received the MAT model improved their average test score by 44 points (close to half a standard deviation). That increase was 19 points higher (a fifth of a standard deviation) than the increase in the group that received regular mathematics classes (table 2). In Buenos Aires the effect of the model was particularly substantial. There, students receiving the MAT model scored 34 points higher (a third of a standard deviation) than those receiving the regular math model.

**One of the aims of the MAT model is to help underperforming students, and the evidence shows that this target group indeed benefitted the most from MAT.** Table 3 shows the average change in test scores for the median and for the bottom and top deciles. Among Tucumán students who were in the bottom decile in the pre-placement test, test scores increased by 64 points, compared with 11 points in the control group. In Buenos Aires, the difference in the bottom decile was even more pronounced (89 point difference). As is clear from table 3, the impact of the MAT model was much less pronounced among students at the median or in the top decile.

The effect sizes varied by MAT module, providing important information on what dimensions need strengthening. The greatest progress was observed in arithmetic, with an average per student improvement rate of 19.4 percent, compared with 13.6 percent in the group that received regular mathematics classes (table 4).

**The degree of implementation of the different modules was predictive of the degree of improvement in test scores.** The arithmetic module, on which students made the greatest progress, was also the module with the strongest implementation as observed through the monitoring of the intensity of the treatment. The geometry module, which had the weakest implementation, produced no significant learning gains. Students received on average only 1.7 classes using the MAT geometry module, compared with 12.1 classes using the MAT multiplication module and 5.2 classes using the MAT module for teaching fractions.

The qualitative evaluation, based on a comparison of all student notebooks in one treatment school over two academic years, reinforced the finding of a link between results and intensity of implementation. During the year of pilot implementation, there

## Table 3. The MAT Model Benefitted Underperforming Students the Most

| Pre-test placement | Group | | Change in test score (standardized points) |
|---|---|---|---|
| In bottom decile | Buenos Aires | MAT | 107 |
| | | Regular Class | 18 |
| | Tucumán | MAT | 64 |
| | | Regular Class | 11 |
| At median | Buenos Aires | MAT | 44 |
| | | Regular Class | 27 |
| | Tucumán | MAT | 28 |
| | | Regular Class | 24 |
| In top decile | Buenos Aires | MAT | 61 |
| | | Regular Class | 14 |
| | Tucumán | MAT | 18 |
| | | Regular Class | 18 |

*Source:* Developed based on data from IIPE-UCUDAL 2010.

## Table 4. Learning Differed by Mathematics Module (standardized changes in percent)

| Module | MAT | Regular model |
|---|---|---|
| Arithmetic | 19.4 | 13.5 |
| Geometry | 12.3 | 11.5 |
| Measurement | 6.7 | 6.5 |
| Total | 16.9 | 9.8 |

*Source:* IIPE-UCUDAL 2010.

was a 33 percent increase over the preceding academic year in the number of classes teaching multiplication. Similarly, the teaching of fractions increased. Although part of the national fourth-grade curriculum, fractions had not been taught at all during the year before the pilot.

# Policy Implications and Next Steps

Few rigorous evaluations have been conducted in Latin America and the Caribbean to provide a basis for how to remediate the pervasive problem of low student achievement in mathematics. The MAT model is based on an approach that is more student-centered than the predominant math model applied in the region. The experimental pilot described in this brief demonstrated that the MAT model had an impact on student learning, particularly among students with the lowest initial test scores. The results varied by mathematics area in step with the intensity of implementation of that area—the implementation of the geometry module, in particular, needs strengthening. The qualitative evaluation also demonstrated that the model produces changes in teachers' perception of students and in their understanding of learning processes. Based on the positive results, with funding from the IDB, the government of Argentina is bringing MAT to a national scale.

## References

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# About the Author

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