Changing Pedagogy to Improve Math Skills in Preschools in Peru

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Sector(s): Education

Fieldwork: Innovations for Poverty Action (IPA)

Location: Ayacucho and Huancavelica regions

Sample: 2,926 children in 107 schools

Target group: Children Students

Outcome of interest: Student learning

Intervention type: Early childhood development

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Partner organization(s): Inter-American Development Bank (IDB), Peru Ministry of Education (MINEDU), Apoyo Institute

As early childhood is an extremely important period for long-term cognitive and non-cognitive development, incorporating promising pedagogical practices in preschools may be an effective way to improve learning outcomes in low- and middle-income countries. In Peru, researchers evaluated the impact of a tailored inquiry- and problem-based learning approach on preschoolers' performance in math. The program improved overall mathematics outcomes, which persisted for some content areas even one year after the program ended. These outcomes did not vary by students' gender, language spoken at home, or proxies for socioeconomic status.

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Changing pedagogical approaches in the classroom, such as by tailoring instruction to an individual student's needs, , has been shown to produce significant and cost-effective gains in learning outcomes. Early childhood, from 0–5 years of age, is an extremely important period for long-term development, and economic and social performance later in life.[1] With this in mind, preschool instruction may be an important time for pedagogical innovations that can improve students' cognitive and non-cognitive skills, especially in low- and middle-income countries.

However, few rigorous evaluations have studied the effects of pedagogical innovations amongst preschoolers in these contexts. Furthermore, the effectiveness of pedagogical innovations at the preschool level may vary in contexts where educational levels differ widely by students' socioeconomic status and teachers are of varying quality. Under what conditions can pedagogical innovations that tailor instruction to an individual student's needs work effectively in a preschool setting?

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In Peru, access to education is high—net enrollment rates in primary and secondary school exceed 95 and 75 percent, respectively. Rates of enrollment for preschool also increased in the years prior to this study, from 53 percent to 75 percent in 2001-2012. Learning outcomes, however, are low compared to countries with similar income levels. Out of seventy countries that participated in the 2015 Program for International Student Assessment (PISA)—a worldwide study of 15-year-olds' scholastic performance—ranked Peru 62nd in math, 64th in science, and 63rd in reading.

Furthermore, learning outcomes vary drastically by socioeconomic status throughout the country, as does teacher quality. Teachers in Peru can either have a non-university degree in teaching offered by a teacher-training institute, or a university-issued teaching degree. In the sample of this evaluation, 60 percent of teachers had a university degree.



Kindergarten participant of Mimate program in Huancavelica, Peru

Photo credit: Ines Levy

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Researchers partnered with the Peruvian non-profit Apoyo Institute, the Inter-American Development Bank, and the Peruvian Ministry of Education to evaluate the impact of using a tailored-instruction program, called Mimate, to teach the existing national mathematics curriculum on preschoolers' numeracy skills. Developed by the Apoyo Institute, the Mimate program aimed to improve Peruvian preschoolers' performance in mathematics using an inquiry- and problem-based learning approach to tailor instruction to students.

Fitting easily into the daily schedule of Peruvian preschools, Mimate consisted of three 45-minute sessions per week and incorporated games, group or pair exercises, and other interactive activities. This method of individualized instruction required

teachers to know exactly where each student stood in terms of his or her understanding of the material. To achieve this, teachers conducted twice monthly formative assessments, using a simple, five-minute round of flash card questions, and subsequently directed each student to the most appropriate activities.

This study took place in public preschool classes in both urban and rural preschools in the south-central Andean cities of Huancavelica, Angaraes, and Ayacucho. Researchers randomly assigned 107 preschools—with a total of 2,926 preschoolers—to either receive the intervention, where teachers were trained and equipped to implement the program, or to a comparison group, which proceeded with existing classroom programming (i.e. teaching practices largely based on group instruction and on memorization and repetition).

In schools that received the intervention, teachers were instructed to deliver the Mimate program in 86 sessions during regular school hours between March and December of 2012. At the start of the program, teachers received a handbook for implementation and underwent three trainings in which they learned how to organize their teaching sessions and direct the activities. Throughout the school year, specialists from Apoyo Institute observed classroom sessions and offered advice on how to improve the application of the program. On average, teachers received six of these coaching visits during the program.

Researchers measured the preschoolers' ability to carry out mathematical tasks, such as recognizing shapes, counting, and basic addition before the program began, at the end of one school year, and one year after the program ended. In a randomly-chosen subset of schools, researchers also videotaped mathematics classes to understand the quality of program implementation.

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The Mimate program improved overall mathematics outcomes, and these persisted for some content areas even one year after the program ended. Researchers found no evidence of differential effects by students' gender, language spoken at home, or proxies for socioeconomic status, though the impacts of the program were largest when implemented by a teacher with a university degree.

Program implementation: Schools receiving the Mimate program implemented, on average, 66 percent of the 86 planned sessions. A national teacher strike disrupted the school year, cancelling up to three months of class time in some schools, and as a result most teachers did not finish all the planned sessions. In classroom observations, all teachers were seen to be using the materials as instructed by the program and boys and girls were included in activities equally. Compared to teachers delivering math classes in comparison schools, Mimate teachers were more prepared with their lessons and had more patience explaining activities to students who did not understand.

Impact on math performance: At the end of the one-year program, Mimate improved students' overall math outcomes. For children in schools that received the intervention, math outcomes improved by between 0.11 and 0.19 standard deviations for items related to numeracy and by between 0.18 and 0.23 standard deviations for items related to understanding shapes. Students scored better on tests measuring their ability to recognize geometric shapes than on those measuring their numeracy skills. This may be due, in part, to the fact that teachers delivered more sessions on shapes than on numeracy, due to national strikes.

One year after the program ended, there were no differences in overall math scores between students who had participated in the program and those who did not participate, though students who participated in Mimate continued to score higher on their ability to recognize geometric shapes.

Effects on different types of students: In preschools that received Mimate, students who had the lowest math skills experienced the largest math gains, in particular for shape scores. This suggests that tailoring lessons to a student's learning level may be more effective for children with lower initial abilities, at least in the short term. Researchers observed no differences in effects of the intervention for students of different genders, language spoken at home, location, classroom size, or socioeconomic

statuses.

Effects under different types of teachers: Learning outcomes improved more for students whose teachers had a university degree. Researchers suggest that better-qualified teachers taught the program more effectively. They had more time to cover the materials and had a more positive outlook on teaching math. As a result, teacher training visits or special attention for less educated teachers may help close this gap.

Cost-effectiveness: The program had an initial cost of about US$120 per student (as of 2017), which included educational materials, cost of teacher training and support, as well as the development of materials used in the program. The annual cost per student to scale up the program around would cost US$37 per student. Researchers estimate that a US$100 investment increased math performance by about 0.38 standard deviations—a large effect size, though less cost-effective than other innovations, like Teaching at the Right Level.

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1. Grantham-McGregor, Sally, Yin Bun Cheung, Santiago Cueto, Paul Glewwe, Linda Richter, Barbara Strupp, and International Child Development Steering Group. 2007. "Developmental potential in the first 5 years for children in developing countries." *The Lancet* 369(9555): 60-70.