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392 schools

Research Implemented by IPA
Yes

Using a Robot to Improve Young Children's Math and Programming Skills in Costa Rica

Abstract

Basic "pre-math" skills in young children have been shown to be important for developing later mathematics competency.[1] In Costa Rica, researchers are evaluating the impact of a technology-based preschool math and coding program on the math and programming skills of preschool-aged children.

Policy Issue

In recent years, most regions of the world have achieved near-universal primary school enrollment. However, the increase in coverage has not corresponded with improvements in student learning. Tests show that students in Latin America lag behind the rest of the world in academic achievement. In order to address low test scores, particularly in mathematics, some education systems invest in inquiry- and problem-based learning as an alternative to rote learning and memorization.This study builds on previous research that found that using information & communications technology (ICT) in classrooms can have positive effects on student learning.

Context of the Evaluation

In Costa Rica, students ranked 60thout of the 71 participating countries in mathematics on the 2015 Program for International Student Assessment (PISA).[1] At 0.4 percent of GDP, public spending on early childhood education in Costa Rica is below the OECD average (0.6 percent) and also below the average for Latin America and the Caribbean (0.5 percent of GDP), which is especially low considering that children under six years old represent 10 percent of Costa Rica's population.[2] Well over half (60 percent) of these children are vulnerable or live in poverty, and the majority are from families with low levels of parental education.[3]

Details of the Intervention

Researchers are partnering with the Costa Rican Ministry of Education and the Inter-American Development Bank to conduct a randomized evaluation testing the impact of the Pensalo program on the math and programming skills of pre-school students aged between 4 and 5 years old. The Pensalo program introduces an intelligent robot named "Albert" ("Betico" in Spanish) that students program by scanning a series of flash cards with instructions that use mathematical and numerical concepts. The program contrasts with traditional classroom practices, which previous research has found focuses on direct transmission of mathematics concepts, by incorporating inquiry- and problem-based techniques.

Researchers have randomly assigned 392 schools in four Costa Rican provinces (Alajuela, Heredia, Limón, and San José) to two different groups:

1. Schools receive the Pensalo program; and
2. Schools in the comparison group, which do not receive the Pensalo program at the time of study.

In the treatment group, researchers use the Pensalo program in 40-minute sessions four times a week–100 sessions in total–during which students are expected to program the robot. Additional materials given to teachers include the flash cards needed to program the robot, a teacher's guide, and a storybook that introduces the concepts the students use to program the robot. Researchers also give parents of the pre-school children the storybook and encourage them to read to their children outside of school. Teachers have participated in a three-day training session on the functioning of the robot and on how to organize the program sessions. They also receive monthly visits from a tutor to assist them and make suggestions on how to improve their teaching sessions.

Researchers conducted an initial survey to test the students' early math and programming skills, oral comprehension, digital skills, and math anxiety. Teachers, principals, and parents also answer questions on socio-demographic information for students and schools. At 30 schools randomly chosen in both the treatment and comparison groups, mathematics classes will be videotaped in order to monitor the quality of the implementation. At the end of the academic year, a follow-up survey will be conducted collecting the same information as the initial survey.

Results and Policy Lessons

Study ongoing; results forthcoming.

Sources

[1]Geary,David C., Mary K. Hoard, Lara Nugent and Drew H. Bailey. 2013. “Adolescents’ Functional Numeracy is Predicted by Their School Entry Number System Knowledge.” Plos One 8(1): 1-8.

[2]OECD. 2018. “PISA 2015: Results in Focus”. https://www.oecd.org/pisa/pisa-2015-results-in-focus.pdf

[3]OECD. 2017. “Education in Costa Rica”. http://www.oecd.org/education/school/Education-in-Costa-Rica-Highlights.pdf

[4]Ibid.

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