

TC Abstract

I. Basic project data

• Country/Region:	ECUADOR/CAN - Andean Group
• TC Name:	Teaching and Learning Math in the Early Grades
• TC Number:	EC-T1373
• Team Leader/Members:	Yyannu Cruz Aguayo (SCL/SCL), Team Leader; Norbert Shady (SCL/SCL); Alternate Team Leader; Vania Pizano (SCL/SCL) project assistant; Sara Anne Ciner (SCL/SCL); and Nicola Dehnen (SCL/SCL) team members.
• Taxonomy:	Client Support
• Date of TC Abstract:	01 Jun 2017
• Beneficiary:	Ecuador's Ministry of Education
• Executing Agency and contact name:	US-IDB - Yyannu Cruz Aguayo
• IDB Funding Requested:	\$ 1,000,000.00
• Local counterpart funding, if any:	\$ 0.00
• Disbursement period:	36 months
• Types of consultants:	Individuals Firms
• Prepared by Unit:	Social Sector
• Unit of Disbursement Responsibility:	Social Sector Department
• Included in Country Strategy:	Yes
• TC included in CPD:	No
• Strategic Alignment:	Social inclusion and equality

II. Objective and Justification

Early math achievement is critical, but what determines how much math young children learn and how can math achievement be improved? This Technical Cooperation seeks to build upon the groundbreaking study in Ecuador, Closing Gaps, to answer that question. Closing Gaps began at the request of the Government of Ecuador in 2012, when an incoming cohort of approximately 15,000 kindergarten children in 202 schools was randomly assigned to their teachers. These children have been randomly re-assigned to teachers year after year in their 1st, 2nd, 3rd, and 4th grades, meaning that Closing Gaps offers a truly unique opportunity to answer some of the most pressing questions about how to improve student mathematics learning. In no country, developed or developing, has there been an experiment that randomly assigned children to teachers in multiple grades.

Specifically, this TC will answer a number of very important questions that both directly and indirectly impact mathematics learning and teaching in elementary school, and will be of great practical use to policy makers in the region. Among them, do children who had a better math teacher in, say, kindergarten or first grade have higher math scores upon graduation from elementary school? Does having a better math teacher in 1st grade matter more or less than having a better math teacher in 4th grade? Are children who had better elementary math teachers more likely to continue on to secondary school? Is the total cumulative effect of having two good teachers greater than the simple sum of the effects of those two individual teachers? Under what circumstances are teachers effective in ensuring that girls, whose math achievement lags behind that of boys, learn math skills? The answers to these questions will allow for more effective and precise policies to improve math learning and teaching in Ecuador and throughout Latin America.

Furthermore, this TC will collect data to compare how math is taught in different classrooms and identify the most effective practices for optimizing student learning. Do teachers who spend more time in intentional, focused math teaching (relative to teaching other subjects) produce more math learning? What is the optimal amount of time spent teaching basic math computations (like addition or subtraction) as opposed to developing children's deeper understanding of math concepts?

The questions to be answered by this TC have never before been rigorously investigated in Latin America. Not only does the TC offer a unique opportunity to understand how young children learn and how to best support

their teachers, but these questions have significant and direct implications for pre-service and in-service teacher training, and for curriculum design.

With greater accuracy than any other study ever conducted in a developing country context, Closing Gaps has established that teacher quality matters a great deal for learning outcomes. The findings to date have critical implications for the formulation of policies for teachers in Latin America and elsewhere. These include:

1. Some teachers are consistently more effective than others at generating student learning gains. This raises the possibility that effective teachers could be rewarded for their performance, while ineffective teachers could be provided with in-service training or other means of remediation.
2. Teacher characteristics, including those that are generally used to select teachers, provide tenure, or make promotion decisions, explain virtually nothing of the differences in teacher effectiveness. This suggests that increasing efforts to develop a “better” ex ante screening tool to identify good and bad teachers may not yield much, at least for elementary-school teachers.
3. Teacher classroom behaviors – what teachers do and say with students every day in the classroom - explain a substantial part of the differences in teacher effectiveness. Research from the United States has shown that these behaviors are malleable—that is, effective in-service training or mentoring programs can improve teacher practices (Bierman et al. 2008; Downer et al. 2013). There would be high returns to policy experimentation and careful evaluation of this kind in Latin America, and in other middle-income countries. Taking these findings a step further to specifically improve children’s math learning is critical for a number of pressing reasons, including gender equality, the ability of poor children to move out of poverty in adulthood, and for national economic growth, to a degree such that Hanushek and Woessman (2012) argue that the difference in growth rates between Latin America and East Asia can be fully explained by the difference in math test scores between the two regions. In fact, the average student in South Korea scores nearly two standard deviations above the average student in Peru on the PISA assessment—a troublingly large difference, by any standard.

Furthermore, a number of longitudinal studies have shown that in school children, mathematical knowledge at early ages strongly predicts career choice, employment, and wages in adulthood (Duncan et al. 2007; Siegler 2009). Although Closing Gaps has already shown that having a better teacher produces more math learning in that year (for example, having a better kindergarten teacher results in more math learning in kindergarten), a number of questions remain to be able to inform more effective policy. For example, it is not clear whether these teacher effects are sustained over time. The current lack of credible estimates of fade-out in Latin America is a serious limitation because policy-makers ultimately want to know how better teachers affect mathematics learning as children age and, in particular, as they make the transition from elementary school to secondary school. This TC will answer those questions for the first time. Finally, this TC will provide much-needed improved math evaluation instruments for the region, as well as specific and practical best practices to improve teacher effectiveness.

III. Description of activities and outputs

Component 1. Measurement of math learning outcomes

Description: Closing Gaps has developed and applied a set of specialized and validated tests to measure learning outcomes. Such instruments have been elaborated in collaboration with the Ministry of Education in Ecuador and under the guidance of leading experts in each field. In each year, year, these tests have been adapted to take into account the progress that the children in the sample should have made by the end of the school-year based on the curricula and developmentally-appropriate abilities. The activities to be financed under this component include: 1) A review and adaptation of the current set of math tests, under the guidance of measurement experts, and with inputs from the current Korean math testing system. This exercise will incorporate new technology to optimize the application of the tests. 2) A pilot and adjustment of the tests to obtain a final version; and 3) the application of the end-of-the-school-year math tests to the complete sample of 17,000 students in their 5th grade.

Output: Databases with the math test results from the sample.

Component 2. Teacher assessment on classroom practices for teaching Math

Description: As it is fundamental to observe what happens inside the classroom in order to determine which practices generate more (or less) learning outcomes, Closing Gaps will continue to use specialized instruments for class observation such as the CLASS, and will incorporate the use of other instruments to assess the quality of math teaching practices. In order to obtain a valid and reliable measure of the quality of the interactions between teachers and students, and of math teaching practices in the classrooms, the main activities to be covered by this component include: 1) filming of at least one full day of classes for each of the approximately 450 teachers in 5th according to the protocols of CLASS and the specialized instrument to assess the quality of math teaching practices; 2) selection, training and evaluation of a team of highly qualified analysts, who will undergo a rigorous certification process to code the videos; 3) editing and coding of the classroom videos following the standardized protocols of each observational tool; and 4) recoding the existing videos of previous years using the math rubric.

Output: Databases with the coded videos.

Component 3. Data analysis and dissemination

Description: This component will finance data analysis and dissemination of results. A number of high quality policy briefs, academic papers, reports and presentations will be produced, including a comparative analysis of math teaching practices in Korea and in Ecuador. On this basis, we will produce a set of recommendations drawn from Korea's best practices. These products will be freely accessible, and will be disseminated through internal and external channels (workshops, seminars, bilateral meetings with government authorities). This component will be implemented jointly with scholars in Korean Universities and/or Korean research institutions, and at least one research fellow from Korea, who will be part of the SCL team.

Output: a series of working papers and policy notes with concrete advice to be used by Ecuador and other countries in the region as input for policy reforms.

IV. Budget

Indicative Budget

Activity/Component	IDB/Fund Funding	Counterpart Funding	Total Funding
I. Measurement of math learning outcomes	\$ 605,000.00	\$ 0.00	\$ 605,000.00
II. Teacher assessment on classroom practices for teaching Math	\$ 260,000.00	\$ 0.00	\$ 260,000.00
III. Data analysis and dissemination	\$ 135,000.00	\$ 0.00	\$ 135,000.00

V. Executing agency and execution structure

This TC will be Bank executed by SCL/SCL's front office through a specialized team led by Yyannú Cruz Aguayo. The Bank will procure the consulting services (individual consultants, consulting firms and non-consulting services) necessary to perform the analysis and data collection activities in accordance with the applicable Bank's policies and procedures. It is foreseen that a single-source procurement will take place as this TC requires to continue with activities that build up from previous work in Ecuador for the same longitudinal study. It is recommended to procure the firm consulting services from Habitus MillwardBrown S. A." ("Habitus") for data collection.

The activities programmed for this TC need to be carried out in strict adherence with the existing methodology employed throughout the past four years of the study, in which the Bank has also been the executing agency using the same executing structure. The Bank has thus developed a competitive advantage. Additionally, it is crucial that at this stage of the study, all the conditions remain constant in order to ensure statistically comparable results.

As for the consulting firm, throughout the past five years, Habitus has generated the optimal capacity to apply surveys and cognitive tests to our selected sample of students. Habitus has also acquired unique experience applying the Classroom Assessment Scoring System (CLASS), and to date are the only firm in Ecuador are trained and certified to apply this instrument following very strict and specific research protocols. Finally, Habitus has developed the institutional knowledge about the schools and students in the study, a crucial element to ensure an adequate follow up at this stage. Additionally, Habitus has worked to establish a good coordination with the MinEduc which allows them to perform the necessary activities in a more efficient way. These elements justify the need for the single-source procurement of a firm with a proven record of expertise in technical fieldwork logistics and on collecting this type of information in several specific key areas of the country.

VI. Project Risks and issues

Specific implementation risks are considered low/medium for the three components. We identified common risks for the implementation of the project: First, the fieldwork may encounter delays to its completion. However, since it is an ongoing operation, we have experienced both internal and external shocks that allowed us to generate contingency protocols to overcome delays in the implementation of the activities. For example, on April 16th, 2016, a 7.8 earthquake hit Ecuador affecting 7% of the schools in the sample. A contingency protocol was implemented in the interest of ensuring that the randomization of students to their 4th grade classrooms would still begin on time with the start of the school year. The MinEduc and the IDB worked together to map out the zones that were affected and a special team was designated to review each and every school in the affected area. Thanks to these efforts, the delays in the activities were kept to a minimum. There is no way to fully

anticipate the effects of possible aftershocks, so the best policy has been to try to identify the affected zones as soon as possible and collaborate closely with the MinEduc to generate a contingency plan. To help anticipate future unknowns, the schedule of activities already takes into account possible delays.

Another possible risk is that a few school principals/teachers/parents might not comply with the planned activities, including the random assignment, testing of students and filming. In those cases, the MinEduc has committed to mediate and correct any deviations from the plan. In the four years of the implementation of the project there has never been an extreme case where a stakeholder refused to participate. Dissemination activities to engage with the stakeholders are always held in coordination with the MinEduc prior the beginning of each school year.

VII. Environmental and Social Classification

The ESG classification for this operation is []