TC ABSTRACT

I. BASIC PROJECT DATA

▪ Country/Region:	Costa Rica
▪ TC Name:	Pre-primary Mathematics with Technology
▪ TC Number:	CR-T1134
▪ Team Leader/Members:	Emma Näslund-Hadley, Team Leader, (SCL/EDU); Alejandro Morduchowiz (EDU/CGU); Fiorella Salazar (EDU/CCR); Elena Arias Ortiz (SCL/EDU); Livia Mueller (SCL/EDU)
▪ TC Taxonomy	Client Support
▪ If Operational Support TC, give number and name of Operation Supported by the TC:	N/A
▪ Reference to Request:	IDBDOC#39424802
▪ Date of TC Abstract:	February 6, 2015
▪ Beneficiary:	Ministry of Education
▪ Executing Agency and contact name:	SCL/EDU
▪ IDB Funding Requested:	US$1,500,000
▪ Local counterpart funding, if any:	US$150,000 (in kind MOE); US$750,000 (parallel financing SK Telecom)
▪ Disbursement and Execution period	Execution: 30 months; Disbursement: 36 months
▪ Required start date:	April 30, 2015
▪ Types of consultants :	Firm and individuals
▪ Prepared by Unit:	SCL/EDU
▪ Unit of Disbursement Responsibility:	SCL/EDU
▪ Included in Country Strategy (y/n);	No
▪ TC included in CPD (y/n):	Yes
▪ GCI-9 Sector Priority:	Yes

II. JUSTIFICATION AND OBJECTIVE

2.1 **Justification.** Pre-primary numeracy abilities and skills have received much less attention than the development of literacy skills at this level. One possible explanation for this neglect is that educators, parents and researchers have been less concerned about children's quantitative abilities in the early years than about their reading skills. The lack of interest in early numeracy may also be the result of a belief that young children have very rudimentary numerical skills, which therefore are of little significance.

2.2 However, a burgeoning research interest in young children's numerical understanding indicates that: (i) very young children are ready and able to develop early numerical skills, using surprisingly sophisticated conceptual constructs in their cognitive activities; (ii) early development of number concepts is essential in developing positive attitudes about mathematics; and (iii) free play is not sufficient for children to reach their full mathematical potential – i.e., they need adult guidance. As a result of these research findings, the disregard of early numeracy is beginning to change. In the hope of smoothing the transition from pre-primary numeracy (e.g., counting) and school-based numeracy (e.g., arithmetic), and reducing the number of students who

need later interventions, governments in many countries have demonstrated interest in providing early numeracy instruction in pre-k and kindergarten.

2.3 In the Latin American and Caribbean region (LAC), the governments' interest in numeracy is further reinforced by international and national tests that have provided concrete evidence for what was previously, a suspected but unverified problem in student achievement in math and science among older students.[1] While significant research is limited on very young children's mathematical achievement in LAC, available cross-national studies indicate that children from Latin America are outperformed by children from other regions. World leaders in early numeracy appear to be children from many Asian countries. In a transnational study of preschoolers, Chinese, Korean and Japanese children scored significantly higher on ten numeracy tasks than those from the United States and Colombia (Ginsburg et al., 1997). Another study, comparing children's early numeracy in England, Finland and China found that young children from Beijing outperformed those from England and Finland in overall early numeracy performance, as well as in sub-tests for understanding of quantities, relations and counting skills (Aunio et al, 2008). Other research show that Korean children exhibit greater self-reliance and sustained attention (Clarke-Stewart et al, 2006) and demonstrate mastery of counting earlier than their U.S. counterparts (Song & Ginsburg, 1987). Researchers have attributed the relative success of Asian students to factors such as classroom practices, teacher attitudes and skills, and parents' values and assistance.

2.4 At the IDB we have collaborated with ministries of education in Belize, Paraguay and Peru to develop and test play-based and hands-on models that seek to help preschool students and their teachers delight in Math together. Although the teaching models differ, the models have a few things in common. First, they seek to make Math meaningful to the student by drawing on the knowledge they bring to the classroom. Second, the instructional strategies reflect critical base competencies and underlying cognitive skills. The sequencing of concepts and constructs is equally important, as children typically build from certain understandings and skills in one area as they move on to new stages of learning. For example, a child's ability to count is fundamental in supporting a wide range of numerical conceptions and single digit addition operations. Third, the teacher is neither a lecturer nor a bystander relegated to passively observe student centered discovery. Instead, the teacher guides the students in their exploration, providing intelligible feedback. Finally, the models are implemented through extensive job-embedded professional development for teachers, including coaching and in-class tutoring. All three models have produced important effects on the pre-math skills that students need to excel in primary level mathematics.

2.5 **Technology in Support of Early Mathematics Skills.** In principle, the use of technology in instruction can significantly enhance the educational process by, for example, increasing student motivation, personalizing instruction, facilitating group work, allowing immediate feedback and real-time monitoring. A growing body of

[1] LAC countries consistently perform poorly in international assessments at the secondary level: even after controlling for per capita GDP, the region's students perform below students in OECD and East Asian countries.

research points to the benefits of using technology the learning process in developing countries, especially for mathematics. However, no rigorous evaluations have been undertaken in Latin America of the use of technology in support of pre-math skills. If implemented with adequate software, and continuous pedagogical and technological support, education technologies can help boost early mathematics skills (Arias and Cristia, 2014), and could potentially also boost the development of pre-math skills.

2.6 **Mathematics Education Reform in Costa Rica**. In 2012 the Government of Costa Rica embarked on a comprehensive reform of primary and secondary level mathematics education, aiming to develop mathematics programs based on international standards. The overall aim of the reform is to strengthen children's problem solving skills (http://www.reformamatematica.net/proyecto/proyecto.html). However, the reform does not encompass the pre-primary level of education, and the Government therefore has requested IDB support in developing and testing a pre-primary mathematics education program.

2.7 **Objective.** Within the context of Costa Rica's recent mathematics curriculum reform, the general objective of the proposed TC is to develop and field-test a technology-based pre-primary program that aims to enhance numeracy learning for the youngest learners.

2.8 **GCI-9 Alignment**. The 9th General Capital Increase (GCI-9) sets out five priority areas. This TC is aligned with the first priority area on social policy for equity and productivity.

III. DESCRIPTION OF ACTIVITIES AND OUTPUTS

3.1 To achieve its objectives, the TC will finance four components: (i) development of a technology-based early mathematics model and learning materials for pre-primary; (ii) implementation of a technology-based early mathematics pilot; (iii) assessment of children's pre-math abilities; and (iv) dissemination of results.

3.2 **Component 1. Development of Early Numeracy Program (US$700,000)**. The TC will finance the creation of a developmentally appropriate technology-based mathematics program for pre-k and kindergarten. The program will offer teachers a sequenced and in-depth coverage of mathematical concepts, such as number, shape, pattern and logic, number operations, and space. The TC will also finance the development of didactic materials for the implementation of the program through interactive smartphone apps on an Android-based technological tool. Both the program and the didactic materials will be developed in close collaboration with teachers, using their feedback and suggestions to change, rearrange and add activities.

3.3 **Component 2. Strengthening early numeracy pilot implementation (US$1,290,000).** The TC will finance the application of the program in a group of schools offering pre-primary education in economically disadvantaged communities (Group I). Tentatively, some 5,000 children and 400 educators will benefit from the pilot. The teachers will receive training and on-going technical assistance to help them understand the concepts and implement the program in their classrooms, including assistance in the use and maintenance of the Android-based technological

devises. Didactic, pedagogical and education technology support materials for the pilot will be distributed. The Pilot will be implemented during one school year.

3.4 **Component 3. Assessment of children's mathematical abilities (US$300,000).** The TC will finance an experimental design of the pilot, contrasting any changes in learning of children in the treatment group with children from a group of comparison schools (Group II). To ensure that statistical inferences can be made from the results, all schools will be selected randomly. Children's mathematical abilities will be tested through an instrument that assesses children's pre-mathematics skills such as counting objects, selecting numbers, naming numbers, selecting shapes, counting and visual discrimination. The collection of the baseline and data processing will take place at the beginning of the school year. The second application of the evaluation instruments will take place during the last two months of the school year.

3.5 **Component 4. Dissemination of pilot results (US$100,000).** The results of the Pilot will be disseminated through a publication and workshops in Costa Rica and at the Bank headquarters in Washington DC. These half day workshops will take place once the evaluation of the Pilot has been completed.

IV. BUDGET

4.1 The total cost of the TC is US$2,400,000, US$1,500,000 which will be charged against the resources of the Korea Poverty Reduction Fund (KPR) and US$750,000 will be provided in the form of parallel financing from SK Telecom, Korea's largest telecom company, which will finance 100% of the hardware costs as well as technical assistance in the use and maintenance of the Android-based technological tool. The remaining US$150,000 will be provided in kind by the Government of Costa Rica.

Table iv-1: Indicative budget in US$

Activity/Component	IDB Funding	SK Telecom	Counterpart Funding (in kind)	Total
Comp. 1. Program Development	500,000	150,000	50,000	700,000
Comp 2. Pilot Implementation	640,000	600,000	50,000	1,290,000
Comp. 3 Assessment	300,000	n/a	n/a	300,000
Comp. 4 Dissemination	50,000	n/a	50,000	100,000
Miscellaneous	10,000	n/a	n/a	10,000
Total	**1,500,000**	**750,000**	**150,000**	**2,400,000**

V. EXECUTING AGENCY AND EXECUTION STRUCTURE

5.1 **Executing agency.** The CT forms part of a regional IDB initiative to promote early childhood mathematics. To ensure linkages with the overarching initiative, and in accordance with a request from the Ministry of Education (IDBDOCS#39364103), TC will be executed by the IDB.

5.2 **Execution period.** The TC will be executed over a period of 30 months and disburse over a period of 36 months as of the date of approval.

5.3 **Procurement.** Standard Bank procurement policies will be used.

VI. PROJECT RISKS AND ISSUES

6.1 The use of education technologies in a Central American context presents logistical challenges. However, the Ministry of Education has many years of experience in the use of education technologies, working with schools in remote geographic areas with difficult terrain. Moreover, SK Telecom will provide technical assistance and training in the use and maintenance of the devises.

VII. ENVIRONMENTAL AND SOCIAL CLASSIFICATION

7.1 The Pilot is not anticipated to have direct negative environmental or social impacts and has been classified as a "C" according to the Safeguard Classification Tool.