

TC ABSTRACT

I. Basic Project Data

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| ▪ Country/Region: | REGIONAL/CAN - Andean Group |
| ▪ TC Name: | Gender and Diversity in Science, Technology, Engineering, Art and Mathematics (STEAM) |
| ▪ TC Number: | RG-T3155 |
| ▪ Team Leader/Members: | NASLUND-HADLEY, EMMA INGRID (SCL/EDU) Team Leader; ALVAREZ MARINELLI, HORACIO (SCL/EDU); CONTRERAS GOMEZ, RAFAEL EDUARDO (SCL/EDU) |
| ▪ Taxonomy: | Research and Dissemination |
| ▪ Number and name of operation supported by the TC: | N/A |
| ▪ Date of TC Abstract: | 09 Jan 2018 |
| ▪ Beneficiary: | Ministries of Education in LA |
| ▪ Executing Agency: | INTER-AMERICAN DEVELOPMENT BANK |
| ▪ IDB funding requested: | \$ 300,000.00 |
| ▪ Local counterpart funding: | \$ 0.00 |
| ▪ Disbursement period: | 24 months |
| ▪ Types of consultants: | Firms |
| ▪ Prepared by Unit: | Education |
| ▪ Unit of Disbursement Responsibility: | Social Sector |
| ▪ TC included in Country Strategy (y/n): | No |
| ▪ TC included in CPD (y/n): | No |
| ▪ Alignment to the Update to the Institutional Strategy 2010-2020: | Social inclusion and equality |

II. Objective and Justification

- 2.1 The objective of this technical cooperation is to capitalize on the successes from the former initiative and deepen our understanding of the social determinants of gender inequality in Science, Technology, Engineering, Art and Mathematics (STEAM) participation and achievement by: (i) implementing an experimental pilot in Colombia to evaluate the effectiveness of the materials developed within the framework of the Gender in Mathematics and Science Learning project (RG-T2589) to promote the interest of girls of 4-5 years in mathematics and science; and (ii) conducting research based on big data computational techniques to continue the line of investigation initiated under RG-T2589 to explore the tone of the STEAM discourse and the extent of gender-based stereotypes amongst Latin American social media users.
- 2.2 International exam results present alarming evidence for girls' STEM education in Latin America. On the 2015 Program for International Student Assessment (PISA), most participating Latin American countries were in the bottom quartile of math and science score distribution, with most also ranking in the bottom quartile of the gender-gap distribution disfavoring girls. As such, Latin American girls are among the least proficient math and science learners in the world (OECD, 2016). While these gaps diminished somewhat, there remain disparities in tertiary graduation rates and research. For instance, in Engineering, women tend to comprise anywhere from 26.6 to 33.7 percent of such graduates, with similar percentages for female Engineering researchers (UNESCO 2015). Over the next decade, these and other labor-participation gender gaps may suppress regional GDP growth by about US\$1 trillion (Cadena and MadGavkar, 2015).

- 2.3 These disparities are tied to gender differences in STEM attitudes, where girls experience more math anxiety than boys, as was the case in the 2012 PISA (CIMA 2016). Math anxiety negatively influences test performance and eventually stifles propensity to participate in STEM professions (Ashcraft and Krause 2007; Casad, Hale and Wachs 2015). Gender biased interactions between care-takers and students may explain attitude differences, as they reinforce stereotypes that boys are better at STEM than girls (Beilock & Maloney 2010; Hembree 1990). Ultimately, girls are disadvantaged by differences in socialization as their interactions negatively influence STEM identity formation (Ashcraft & Kirk, 2001). These gaps are more severe for afro-descendent and indigenous girls (Riegle-Crumb & Humphries, 2012; Atal, Nopo, & Winder, 2009) and vary depending on cultural characteristics (O'Brien, Blodorn, Adams, Hammer & Garcia, 2015), but little research exists for the Latin American context. The limited research supports findings that gender and ethnic stereotypes are population-dependent (Gonzalez, Blanton & Williams, 2002), but more research could improve STEM program design.
- 2.4 In response to these challenges, the IDB initiated the Gender in Math and Science Learning (GMSL) project (RG-T2589) in 2015 to enhance girls' STEM learning and participation. Among these, it created: (i) a research-based curriculum that appeals to girls, (ii) 18 Pequeñas Aventureras webisodes where Lola, a Sesame Workshop (SW) puppet, introduces girls to female STEM role-models, (iii) three SW public announcements encouraging GMSL participation, (iv) social media content promoting gender equity in STEM, (v) 5 E-books addressing gender and STEM issues and (vi) other informational materials. In collaboration with the Office of the President, the campaign launched in Mexico in 2017 and is expected to benefit nearly 40,000 children by 2018. The digital campaign has also been successful, with close to 2 million people accessing the material and over 30 media platforms reporting on the campaign.
- 2.5 The GMSL project also financed a Big Data analysis of Social Network STEM discourse in Latin America. The analysis showed that females are more likely than males to express affinity to negative STEM attitudes and that female STEM role-models presence in Latin America social media is very low. The few positive mentions of female STEM participation came from networks dedicated to this cause, while male STEM role-models were overrepresented in social media news and content.

III. Description of Activities and Outputs

- 3.1 In line with its objectives, this operation consists of two components. First, the TC will finance the piloting of the Pequeñas Aventureras materials created through RG-T2589 to assess how they affect preschoolers in Cali, Colombia. Research questions that will be explored include but are not limited to: Do the materials help diminish gender stereotypes about STEM? How does Pequeñas Aventureras impact parents' gender stereotypes? Are there differential effects for double-disadvantaged students (afro-descendent/indigenous and female)? Do double-disadvantaged students benefit from targeted treatment? The pilot will be conducted as a student level randomized control trial (RCT) stratified to measure impact on afro-descendant and indigenous populations in this region. Preschoolers and their parents will be assigned to one of three possible situations. First, a control group which will receive the status-quo access to preschool education (Group I). Second, there will be a Gender and STEM arm (Group II) where participants will benefit from education using the Pequeñas Aventureras curriculum. Third, there will be a Gender and Diversity arm (Group III) where participants will also benefit from exposure to local afro-descendent and indigenous STEM role models. The TC will extend the analysis of social network discourse through enhanced Big Data methodologies and improved natural language processing (NLP) algorithms with the intent of accentuating understanding of how STEAM topics are perceived differently by gender, race and indigenous identity. This

analysis will also identify mechanisms which perpetuate social stereotypes regarding girls' participation in STEAM learning by tracking the promulgation of stereotypes through different populations. The extension of this analysis will require the development of sophisticated Application Program Interfaces (API) and sociologically informed NLP algorithms that allow the team to harvest and analyze information from dynamic and voluminous social network data.

- 3.2 **Component I: Pequeñas Aventureras Pilot.** Pilot Pequeñas Aventureras materials (RG-T2589) to assess effectiveness in Cali, Colombia. The pilot will be a randomized control trial (RCT) stratified to assess impact on afro-descendent and indigenous students. The control group will receive status-quo education (Group I), while treatment group will benefit from Pequeñas Aventureras lessons (Group II). A second treatment group (Group III) will learn from program materials and be exposed to afro-descendent or indigenous role-models.
- 3.3 **Component II: Social Network Analysis.** Extend the social network analysis of STEM discourse using Big Data methodologies to acquire a deeper understanding of how STEAM topics are perceived differently by gender, race and indigenous identity throughout the region. Additionally, the analysis will be conducted in countries where there are no gender gaps in STEM outcomes and those with high a Gender Development Index to understand how STEM perceptions are associated with different outcomes.

IV. Budget

Indicative Budget

| Activity/Component | IDB/Fund Funding | Counterpart Funding | Total Funding |
|----------------------------|------------------|---------------------|---------------|
| Pequeñas Aventureras Pilot | \$ 250,000.00 | \$ 0.00 | \$ 250,000.00 |
| Social Network Analysis | \$ 50,000.00 | \$ 0.00 | \$ 50,000.00 |

V. Executing Agency and Execution Structure

- 5.1 The project will be Bank executed. The Bank will be responsible for all aspects of project management, including the administration of resources, and the contracting of specialized consulting services in accordance with Bank policies and procedures. The Bank has the appropriate systems, administrative capacity and expertise in the area to be able to carry out the selection and hiring of quality consulting services.
- 5.2 Consistent with the Policy for the Selection and Contracting of Consulting Firms for Bank-Executed Operational Work (GN-2765-1), resources from Component I will be used to directly contract Sesame Workshop for the implementation of the treatment in Groups II and III. Sesame Workshop is a non-profit organization, legally constituted in the United States. Sesame Workshop has produced several educational children's programs, including Sesame Street that has been televised internationally. Sesame workshop was contracted to develop the educational materials for Pequeñas Aventureras (RG-T2589), which are of high quality and have already reached approximately 2 million beneficiaries.
- 5.3 The Policy for the Selection and Contracting of Consulting Firms for Bank-Executed Operational Work (GN-2765-1) and the Operational Guidelines (GN-2765-3) allow for single source selection in: (a) cases where tasks represent a natural continuation of previous work carried out by the firm; and (b) for small assignments where the contract value is US\$100,000 or less. The direct contracting of Sesame Workshop complies with both criteria.

- 5.4 The TC will form part of a regional IDB initiative, Balancing the Equation, that has the dual objective to: (i) change the conversation in LAC about women in Science, Technology, Engineering, Art and Mathematics (STEAM); and (ii) position the IDB as a trusted source of knowledge and partner in the area of Gender and Diversity in STEAM. The Bank's network of counterparts - in governments, corporations and civil society - makes it uniquely positioned to lead this work.

VI. Project Risks and Issues

- 6.1 A pilot based on an experimental design in a context such as Colombia presents logistical challenges. The IDB has an extensive experience of implementing randomized control trials in STEM education throughout the region which will mitigate execution risks (e.g. JA-T1094, PE-T1232, PR-T1182, PR-T1092, and BL-L1018). These previous experiences make the Team confident that the proposed design is feasible.

VII. Environmental and Social Classification

- 7.1 The ESG classification for this operation is "undefined".