TECHNICAL COOPERATION (TC) DOCUMENT

I. Basic Information for TC

▪ Country/Region:	Regional
▪ TC Name:	Gender and Diversity in Science, Technology, Engineering, Art and Mathematics (STEAM)
▪ TC Number:	RG-T3155
▪ Team Leader/Members:	Emma Naslund-Hadley, (SCL/EDU) Team Leader; Juan Maragall and Horacio Álvarez (EDU/CCO); Johan Rocha and Rafael Contreras Gomez (SCL/EDU); Judith Morrison (SCL/GDI); Betina Hennig (LEG/SGO); and Miguel Orellana (VPC/FMP).
▪ Taxonomy:	Research and Dissemination
▪ Date of TC Abstract authorization:	23 February 2018
▪ Beneficiary:	Ministries of Education in IDB member countries in Latin America and the Caribbean
▪ Executing Agency:	The IDB, through SCL/EDU
▪ Donors providing funding:	Gender and Diversity Multi-Donor Fund (MGD)
▪ IDB Funding Requested:	US$300,000
▪ Disbursement period:	24 months
▪ Required start date:	15th August 2018
▪ Types of consultants:	Firms and individuals
▪ Prepared by Unit:	SCL/EDU
▪ Unit of Disbursement Responsibility:	SCL/SCL
▪ TC included in Country Strategy:	No
▪ TC included in CPD (y/n):	No
▪ Alignment to the Update to the Institutional Strategy 2010-2020:	Social inclusion and equality

II. Objectives and Justification of the TC

2.1 Results from international exams present alarming evidence about the state of girls' mathematics and science education in Latin America. On the 2015 Program for International Student Assessment (PISA) exam, all participating non-OECD Latin American countries produced gender gaps in favor of boys that were nearly double the OECD average (OECD, 2015). Additionally, most participating Latin American were in the bottom quartile of mathematics and science performance distribution, with at least one-third of those amongst the 10 worst performing nations. Given that these same countries also rank in the bottom quartile of the mathematics and science gender-gap distribution in favor of boys, it can be argued that Latin American girls are among the least proficient mathematics and science learners in the world (OECD 2016). These disparities translate into gender gaps in tertiary graduation rates, particularly in Engineering where women comprise 31.0% in Argentina, 29.5% in Brazil, 32.1% in Colombia, 33.7% in Costa Rica, and 26.6% in el Salvador. While these gaps are relatively narrow compared to other countries, including OECD countries, female participation rates in engineering and physical and computer sciences has declined consistently in the LAC region over the past decade, and especially so in the larger economies such as Argentina, Brazil, Chile, and Colombia. The only exception

is Mexico, where participation rates have increased slightly (UNESCO 2015). Over the next decade, the generally decreasing proportion of economically active women compared to men – particularly in Science, Technology Engineering and Mathematics careers – is estimated estimated to suppress regional GDP growth by more than US$1 trillion (Cadena and MadGavkar, 2015).

2.2 A large body of literature indicates that the lack of women in Science, Technology Engineering and Mathematics careers has its roots in adverse feelings towards mathematics, which has been shown to negatively influence test performance and may also explain some of the gender disparity in mathematics proficiency in Latin America (Hembree 1990; Ma 1999; Ho et al 2000; Ashcraft and Krause 2007; Vukovic et al. 2012; Devine et al. 2012; Casad, Hale and Wachs 2015). Mathematics anxiety, or negative emotional associations with mathematics-related work, is theorized to interfere with working memory, and thus render necessary mathematics information inaccessible to students as they solve mathematics problems (Ashcraft and Krause 2007). Mathematics confidence and anxiety are also correlated with future participation in mathematics-related studies and careers. In a meta-analysis of 151 studies on the effects of mathematics anxiety, Hembree (1990) shows that students with higher levels of mathematics anxiety enrolled in fewer elective mathematics courses and expressed less interest in pursuing high-school and college mathematics.

2.3 On the 2012 PISA, students of both sexes from participating LAC countries reported higher levels of mathematics anxiety than their OECD peers, and in all these countries, female students reported experiences significantly higher levels of mathematics anxiety than their male peers (OECD, 2012). In other words, LAC girls are not only among the lowest performers in mathematics, but also experience some of the highest levels of mathematics anxiety in the world. Evidence suggests that these disparities may partially be influenced by gender differences in teacher or parent interactions with students, especially when those interactions reinforce gender stereotypes that boys are more suitable for mathematics than girls (Beilock & Maloney 2010; Hembree 1990). In other words, girls may be acquiring at least some of their mathematics anxiety from day-to-day interactions, and because mathematics anxiety effects learning, girls are, to some extent, disadvantaged by gender differences in socialization (Ashcraft & Kirk, 2001).

2.4 The gender gaps in Science, Technology, Engineering and Mathematics learning and participation are even more prominent for afro-descendent and indigenous girls (Riegle-Crumb & Humphries, 2012; Atal, Nopo, & Winder, 2009). These gaps can depend on the specific population being considered, where males in patriarchal societies can vary somewhat on the intensity and characteristics of their beliefs regarding women as well as for how females view themselves (O'Brien, Blodorn, Adams, Hammer & Garcia, 2015). There has been little research regarding these variations in the Latin American and Caribbean afro-descendant and indigenous populations, and the dearth of knowledge regarding these topics potentially limits the impact of interventions as they fall short of addressing population specific needs. The little research available regarding these populations supports international findings by showing that the prevalence and intensity of gender and ethnic stereotypes may be population-dependent (Gonzalez, Blanton & Williams, 2002).

2.5 In response to these challenges, the IDB launched the Gender in Mathematics and Science Learning project (RG-T2589; ATN/OC-15005-RG) in 2015 with the objective of developing a campaign and education materials to promote the importance of mathematics and science for girls and facilitate their participation in these subjects.

This ambitious project produced significantly positive results; it created: (i) an innovative and research-based mathematics curriculum targeted to increase the appeal of mathematics for girls; (ii) 18 *Pequeñas Aventureras* webisodes in which Lola, a beloved puppet from the Sesame Workshop, interacted with female STEAM role models; (iii) three public announcements featuring Lola from the Sesame Workshop to encourage participation in program content; (iv) social media content to promote gender equity in STEAM learning; (v) 5 E-books promoting themes associated with gender and STEAM learning; (vi) community outreach materials (www.iadb.org/matematicas); and (vii) activities for preschool classrooms, including a teacher's guide and classroom activities. The campaign was launched in Mexico in 2017 in collaboration with the Office of the President. In addition, current trends suggest that by the end of 2018, nearly 40,000 children will have benefitted from community materials. The digital campaign has been incredibly successful as it has been accessed by close to 2 million people and received wide media coverage in over 30 digital and print platforms, potentially changing how young girls are socialized to think about STEAM learning.

2.6 The Gender in Mathematics and Science Learning project (RG-T2589; ATN/OC-15005-RG) also financed a Big Data analysis of Social Network discourse regarding Science, Technology, Engineering and Mathematics throughout Latin America. The analysis revealed that gender stereotypes are prevalent in Latin American social media and that girls and young women are more likely than male social media users to post and feel affinity to posts that promote negative views of Science, Technology, Engineering, and Mathematics subjects. Furthermore, the analysis showed that women's participation in Science, Technology, Engineering and Mathematics careers is largely invisible in science and engineering articles shared in social media platforms in Latin America. The only positive mentions of girls and women in Science, Technology, Engineering and Mathematics originate from networks specifically dedicated to gender equality in STEAM, and there is an overrepresentation of male lead researchers and scientists in social media images and mentions of Science, Technology, Engineering and Mathematics discoveries and innovations.

2.7 **Objective**. The objective of this TC is to capitalize on the successes achieved so far and deepen the understanding of the social determinants of gender inequality in STEAM participation and achievement by: (i) implementing an experimental pilot in Colombia to evaluate the effectiveness of the materials developed within the framework of RG-T2589 (ATN/OC-15005-RG) 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 (ATN/OC-15005-RG) to explore the tone of the Science, Technology, Engineering and Mathematics discourse and the extent of gender-based stereotypes among Latin American social media users. Results from this project will guide future education program design to help increase exposure to diverse role-models and girls' participation in STEAM education.

2.8 **Strategic Alignment**. At an institutional level, Science, Technology, Engineering and Mathematics is a priority within the Bank's Sector Framework Documents for Education and Early Childhood Development (GN-2708-5) and Gender and Diversity (GN-2800-5); the Strategy on Social Policy for Equity and Productivity (GN-2588-4); the Bank's Strategy with Colombia 2015-2018 (GN-2832-1); and the Updated Institutional Strategy 2010-2020 (UIS) (AB-3008). The Education and Early Childhood Development and Gender and Diversity Sector Framework Documents prioritize

women and girls in Science, Technology Engineering and Mathematics as these interventions not only help close learning gaps on international standardized tests, but also contribute to economic growth. The UIS identifies social inclusion and equity, two macro-level challenges addressed by this operation. The operation is aligned and consistent with GN-2513-3, which guides financing of the Bank's Gender and Diversity Multi Donor Fund (GDM), including this operation. The operation is also aligned with auxiliary indicator number 2 of the Corporate Results Framework 2016-2019 (GN-2727-6), which measures the number of "children receiving early childhood development services targeted to the poor."

III. Description of Activities/Components and Budget

3.1 In line with its objectives, this operation consists of two components:

3.2 **Component I – *Pequeñas Aventureras* Pilot (US$90,000).** 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 STEAM? 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?

3.3 The pilot will be conducted as a household-level randomized control trial (RCT) stratified to measure impact in afro-descendant and indigenous populations in Cali, located in the southwest region of Colombia.[1] Preschoolers and their parents will be assigned to one of three possible situations: (i) a control group which will receive the status-quo access to preschool education (Group I); (ii) a teacher training arm (Group II) where participants will benefit from education using the *Pequeñas Aventureras* curriculum; and (iii) a teacher and parent training arm (Group III) where participants will also benefit from exposure to local afro-descendent and indigenous STEAM role models.[2]

3.4 Households will be selected among beneficiaries of Community Household (HC) services that provide comprehensive care for girls and boys under the age of 5. The services are provided by a community mother, who serves 10 to 12 children with the support of an interdisciplinary team composed of a psychosocial professional, a health and nutrition professional, and a pedagogue.

3.5 **Component II – Evaluation and Analysis (US$180,000)**. The TC will finance an impact evaluation of the randomized control pilot. Based on a database of HC beneficiary households, the team will randomize 250 community households into one of three possible situations: (i) a control group which will receive the status-quo access to goods and services that the Colombian government and the social society provides for families with preschool children; (ii) a treatment arm (Group I) where teachers will be trained in the use of the *Pequeñas Aventureras* materials; and (iii) an arm (Group II)

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[1] The area of the pilot was selected based on two criteria: (i) the presence of a large Afro-descendent population; and (ii) an organization with the qualification and network to implement the pilot, as well as capacity to contribute in-kind with the training of early childhood educators.

[2] There is some evidence that role models help improve learning and self-esteem among women and students of color. See Zirkel 2002 and Yancey, Siegel and MacDaniel 2002.

where both teachers and parents will be trained in the use of *Pequeñas Aventureras*. The rational for the inclusion of parents in Group II is grounded in research that shows that parental stereotypes about mathematics influences student perceptions about the subject.[3]

3.6 Based on an experimental design, power calculations were carried out using Optimal design. From the different scenarios, we propose using a 0.15 minimum detectable effect size for both treatments, which is within the expected effects of this type of intervention, and a rho of 0.10 based on the assumption that community households have similar characteristics to each other. These assumptions establish a sample of 134 schools for each treatment group, and a sample of 268 schools for the control group. In total the experiment requires 536 schools (see Annex V for power calculations).

3.7 Component II will finance the collection of baseline and endline data, using evaluation instruments that include a test of gender and racial attitudes. Additionally, the evaluation will include measures of parent-child interactions, parent attitudes and beliefs. Based on socialization theory, which states that gender differences in mathematics and science learning outcomes are partially the result of interactions between the sex of an individual and gender stereotypes regarding mathematics and science[4], the evaluation will also include early learning tests such as the Early Childhood Longitudinal Study (ECLS-K) kindergarten mathematics and science;[5] or the preschool version of the Early Grade Math Assessment (EGMA).[6] All instruments will be validated to ensure that they work accurately in the setting of the pilot.

3.8 **Component III – Social Network Analysis (US$30,000).** This component 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. Geographically, the analysis will cover the countries were found to have the most extensive science, technology, engineering and mathematics social media discourse through RG-T2589: Argentina, Brazil, Chile, Colombia, Mexico, and Peru.

3.9 **Budget**. The total cost of this TC is US$300,000 (non-reimbursable), which will be financed with resources from the Bank's Gender and Diversity Multi-Donor Fund (MGD) and disbursed over 24 months. The indicative budget is presented in Table 1 below.

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3 Tomasetto, Mirisola, Galdi and Cadinu 2015.

4 Hembree 1999; Gunderson, Ramirez, et al. 2012; Beilock and Maloney 2015.

5 The ECLS-K instruments were developed by the Institute for Education Sciences and have been used in three national longitudinal surveys that examine child development, school readiness, and early school experiences in the United States.

6 EGMA was developed by the Research Triangle Institute (RTI) and has been used extensively in early grades throughout the developing world. The preschool version was adapted by the IDB and Innovation for Poverty Action (IPA) and has been validated and used in five countries in LAC.

Table 1. Indicative Budget (in $US)

Activity/Component	IDB/Fund	Total Funding
Component I. *Pequeñas Aventureras* Pilot	**90,000**	**90,000**
Sesame Workshop muppet appearances	10,000	10,000
Development of additional Sesame Workshop materials	30,000	30,000
Coordination Fundación Carvajal	30,000	30,000
Training of HC Mothers	20,000	20,000
Component II. Evaluation and analysis	**180,000**	**180,000**
Baseline	80,000	80,000
Endline	80,000	80,000
Analysis	20,000	20,000
Component III. Big data analysis	30,000	30,000
Analysis	30,000	30,000
Total:	**300,000**	**300,000**

IV. Executing Agency and Execution Structure

4.1 The project will be Bank-executed. The results envisioned by this operation require the sequencing and close coordination of activities undertaken of different actors (public sector, civil society, academia, and the Bank). Through its ongoing policy dialogue with the beneficiary countries, civil society organizations, and the STEAM and early childhood development research communities; as well as experience from big data analysis and RCTs, the Bank is better placed to coordinate of all activities to be financed by this TC and to serve as the executing agency of this operation.

4.2 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. Responsibilities for supervision and monitoring this operation will fall to SCL//EDU, including regular meetings with counterparts and consultants, as well as supervision missions.

4.3 Procurement of consulting and non-consulting services will be carried out in accordance with IDB's policies. Specifically, Section AM-650 of the Administrative Manual "Complementary Workforce" will be applied in the case of individual consultants; the Policy for the Selection and Contracting of Consulting Firms for Bank-executed Operational Work (GN-2765-1) and its Operational Guidelines (OP-1155-4) for hiring consulting services of intellectual nature and the Corporate Procurement Policy (GN-2303-20) for other services."

4.4 Resources from Component I will be used to directly contract Fundación Carvajal and 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. It has

produced several educational children's programs, including Sesame Street, that have 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. Fundación Carvajal is a non-profit organization created to improve the quality of life in vulnerable communities in Cali and Buenaventura, Colombia. Since its creation in 1990, it has implemented 88 projects, many with the HC, benefitting 26,000 people. Fundación Carvajal will implement the proposed pilot within the framework of its existing project *Saberes* and contribute in kind with the time of its trainers. The Fundación Carvajal trainers provide the educators in the HC with 8 hours of face-to-face training per month, as well as virtual support through an online platform. The *Pequeñas Aventureras* materials would tentatively be used during one of the eight monthly training hours. Similarly, the Fundación Carvajal trainers provide monthly training to parents where the *Pequeñas Aventureras* materials will be integrated as one component.

4.5 The direct selection of these two entities is consistent with the Policy for the Selection and Contracting of Consulting Firms for Bank-executed Operational Work (GN-2765-1) which allows for single-source selection in cases: (i) where tasks represent a natural continuation of previous work carried out by the firm; (ii) when only one firm is qualified or has experience of exceptional worth for the assignment and it presents a clear advantage over competition; (iii) for small assignments where the contract's value is US$100,000 or less; (iv) in emergency cases, such as in response to disasters and for consulting services required immediately following the disaster. The direct contracting of Sesame Workshop complies with all criteria, except the emergency disaster criteria. The contracting of the Carvajal Foundation complies with (i) and (iii).

V. Major Issues

5.1 A pilot based on an experimental design in low-income areas in Colombia presents logistical challenges. The commitment of the Government of Cali to the study; the vast experience of the Fundación Carvajal in implementing projects among Community Households in Cali; and the Bank's extensive experience in implementing RCTs in the education sector, including STEM and early childhood interventions (AR-T1047, ATN/OC-11253-AR; PR-T1092, ATN/JF-11945-PR; JA-T1094, ATN/JF-14478-JA; PN-T1056, ATN/NP-11051-PN; and PE-T1232; ATN/JO-12960-PE), make the team confident that the proposed design is feasible. The risks associated with this operation are reduced given that its products are produced through consultancies contracted by the Bank. Moreover, Fundación Carvajal has extensive experience working with the beneficiary households, which makes the project team confident in the design.

VI. Exceptions to Bank Policy

6.1 None.

VII. Environmental and Social Strategy

7.1 The TC is not anticipated to have direct environmental or social impacts and has been classified as "C" according to the Safeguard Classification tool (see Safeguard Policy Filter Report and Safeguard Screening Form).

Required Annexes:

- Annex I: Letter of request and letter of non-objection (pending)
- Annex II: Results Matrix
- Annex III: Terms of Reference
- Annex IV: Procurement Plan
- Annex V: Power calculation (additional)

República de Colombia
Instituto Colombiano de Bienestar Familiar
Cecilia De la Fuente de Lleras
Dirección General

Bogotá D.C., junio 15 de 2018

SEÑORES
BANCO INTERAMERICANO DE DESARROLLO- BID
Atn: Rafael De La Cruz
Representante en Colombia
Carrera 7#71-21 Torre B, piso 19
Bogotá D.C

Cordial saludo,

En aras de potenciar el proceso pedagógico y educativo en nuestros programas de primera infancia, establecemos como prioridad apoyar proyectos que fortalezcan y mejoren los procesos de la atención integral en nuestras unidades de servicio, por tal razón, solicitamos apoyo del Banco interamericano de desarrollo-BID para desarrollar un proyecto conjunto que permita mejorar los procesos de desarrollo de nuestros niños y niñas.

El Instituto Colombiano de Bienestar Familiar - ICBF manifiesta el interés en recibir apoyo del BID, enmarcado en un convenio que nos permita obtener apoyo técnico basado en las investigaciones y trabajos que ustedes lideran y así contribuir a la mejora de la calidad de nuestra atención en primera infancia.

Lograr llegar a las unidades de servicio del ICBF con un programa estructurado que le permita a los agentes educativos contar con herramientas y estrategias que propicien el potenciamiento de las habilidades en las áreas de lenguaje, pre-matemáticas, ciencias y tecnologías es una apuesta que permitirá fortalecer el desarrollo integral de los niños y las niñas de primera infancia y con esto, contribuir al desarrollo social, educativo y comunitario de las regiones a las que se logre acompañar.

Dicha solicitud de cooperación técnica se encuentra enmarcada en la estrategia de Fortalecimiento de la Educación Inicial liderado desde la Dirección de Primera infancia del Instituto Colombiano de Bienestar Familiar, puntualmente en el componente de Procesos Pedagógicos que hace parte de los 6 componentes de calidad de la Educación Inicial en el marco de la Atención Integral

Atentamente,

Karen Abudinen Abuchaibe
Directora General del ICBF

Results Matrix

Outcomes

Outcome: 1 An understanding of the social determinants of gender inequality in STEAM participation and achievement; le education intervention to increase girls' participation in STEAM education.

CRF Indicator

Outputs: Annual Physical and Financial Progress

1 Pequeñas Avenureras Pilot

Outputs	Output Description	Unit of Measure	Baseline	Baseline Year	Means of verification		Physical Progress 2018	Physical Progress 2019	Physical Progress EOP		Financial Progress 2018	Financial Progress 2019	Financial Progress EOP	Theme	Fund	Flags
1.1 Pilot interventions implemented	RCT	Pilots (#)	0	2018	Database	P	0	1	1	P	0	70000	70000	Education	MGD	
						P(a)	0	1	1	P(a)	0	70000	70000			
						A				A						
1.2 Individuals Trained	Workshops for community household educators	Individuals (#)	0	2018	Reports from Fundacion Carvajal uploaded to EZShare	P	0	133	133	P	0	20000	20000	Gender and Diversity	MGD	
						P(a)	0	133	133	P(a)	0	20000	20000			
						A				A						

2 Evaluation and Analysis

Outputs	Output Description	Unit of Measure	Baseline	Baseline Year	Means of verification		Physical Progress 2018	Physical Progress 2019	Physical Progress EOP		Financial Progress 2018	Financial Progress 2019	Financial Progress EOP	Theme	Fund	Flags
2.1 Experimental impact evaluation (ex-ante or ex-post) performed	RCT implemented	Evaluation Final Report (#)	0	2018	Results from impact evaluation uploaded on EZ-sHARE	P	0	1	1	P	80000	100000	180000	Gender and Diversity	MGD	
						P(a)	0	1	1	P(a)	80000	100000	100000			
						A				A						

3 Social Network Analysis

Outputs	Output Description	Unit of Measure	Baseline	Baseline Year	Means of verification		Physical Progress 2018	Physical Progress 2019	Physical Progress EOP		Financial Progress 2018	Financial Progress 2019	Financial Progress EOP	Theme	Fund	Flags
3.1 Diagnostics and assessments completed	Assessment	Diagnostics (#)	0	2018	Big data analysis.	P	0	1	1	P	25000	5000	30000	Education	MGD	
						P(a)	0	1	1	P(a)	25000	5000	5000			
						A				A						

Other Cost

Total Cost

	2018	2019	Total Cost
P	$105,000.00	$195,000.00	$300,000.00
P(a)	$105,000.00	$195,000.00	$195,000.00
A			

CRF Indicator Standard Output Indicator

TERMS OF REFERENCE

Baseline and Endline for *Pequeñas Aventureras* Pilot

RG-T3155

Gender and Diversity in Science, Technology, Engineering, Art and Mathematics (STEAM)

1. Background and Justification

1.1. Established in 1959, the Inter-American Development Bank ("IDB " or "Bank ") is the main source of funding for economic, social and institutional development in Latin America and the Caribbean. The IDB provides loans, grants, guarantees, policy advice and technical assistance to the public and private sectors of the borrowing countries.

1.2. Results from international exams present alarming evidence about the state of girls' mathematics and science education in Latin America. On the 2015 Program for International Student Assessment (PISA) exam, all participating non-OECD Latin American countries produced gender gaps in favor of boys that were nearly double the OECD average (OECD, 2015). Additionally, most participating Latin American were in the bottom quartile of mathematics and science performance distribution, with at least one-third of those amongst the 10 worst performing nations. Given that these same countries also rank in the bottom quartile of the mathematics and science gender-gap distribution in favor of boys, it can be argued that Latin American girls are among the least proficient mathematics and science learners in the world (OECD 2016). These disparities translate into gender gaps in tertiary graduation rates, particularly in Engineering where women comprise 31.0% in Argentina, 29.5% in Brazil, 32.1% in Colombia, 33.7% in Costa Rica, and 26.6% in el Salvador. While these gaps are relatively narrow compared to other countries, including OECD countries, female participation rates in engineering and physical and computer sciences has declined consistently in the LAC region over the past decade, and especially so in the larger economies such as Argentina, Brazil, Chile, and Colombia. The only exception is Mexico, where participation rates have increased slightly (UNESCO 2015). Over the next decade, the generally decreasing proportion of economically active women compared to men – particularly in Science, Technology Engineering and Mathematics careers – is estimated estimated to suppress regional GDP growth by more than US$1 trillion (Cadena and MadGavkar, 2015).

1.3. A large body of literature indicates that the lack of women in Science, Technology Engineering and Mathematics careers has its roots in adverse feelings towards mathematics, which has been shown to negatively influence test performance and may also explain some of the gender disparity in mathematics proficiency in Latin America (Hembree 1990; Ma 1999; Ho et al 2000; Ashcraft and Krause 2007; Vukovic et al. 2012; Devine et al. 2012; Casad, Hale and Wachs 2015). Mathematics anxiety, or negative emotional associations with mathematics-related work, is theorized to interfere with working memory, and thus render necessary mathematics information inaccessible to students as they solve mathematics problems (Ashcraft and Krause 2007). Mathematics confidence and anxiety are also correlated with future participation in mathematics-related studies and careers. In a meta-analysis of 151 studies on the effects of mathematics anxiety, Hembree (1990) shows that students with higher levels of mathematics anxiety enrolled in fewer elective mathematics courses and expressed less interest in pursuing high-school and college mathematics.

1.4. On the 2012 PISA, students of both sexes from participating LAC countries reported higher levels of mathematics anxiety than their OECD peers, and in all these countries, female students reported experiences significantly higher levels of mathematics anxiety than their male peers (OECD, 2012). In other words, LAC girls are not only among the lowest performers in mathematics, but also experience some of the highest levels of mathematics anxiety in the world. Evidence suggests that these disparities may partially be influenced by gender differences in teacher or parent interactions with students, especially when those interactions reinforce gender stereotypes that boys are more suitable for mathematics than girls (Beilock & Maloney 2010; Hembree 1990). In other words, girls may be acquiring at least some of their mathematics anxiety from day-to-day interactions, and because mathematics anxiety effects learning, girls are, to some extent, disadvantaged by gender differences in socialization (Ashcraft & Kirk, 2001).

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1.7. To capitalize on the successes achieved so far, the Ministry of Education in Cali, Colombia, and the IDB have joined forces to implement an experimental pilot in Cali to evaluate the effectiveness of the materials developed within the framework of the RG-T2589 to promote the interest of girls of 4-5 years in mathematics and science.

1.8. Against this background, the IDB is looking to contract a firm to assit with the experimental evaluation of the pilot, including design and validation of the instrument, the collection of the baseline and endline.

2. Objectives

2.1. Consulting services are required to carry out the impact assessment of the pilot project "Pequeñas Aventureras" in Cali, Colombia.

3. Scope of Services

3.1. The scope of the evaluation includes a minimum of 536 community households with an average of 10 to 12 students; as well as parents of 134 students.

4. Key Activities

4.1. The key activities include, but are not limited to the following:

- Develop and submit a first draft of a detailed work plan for the consultancy, including the description of the activities to be carried out and its products, a schedule of activities and deliverables.
- Obtain the approval of the study by an IRB (Institutional Review Board) to ensure that the rights and welfare of the participants in the study are protected.
- Design and/or validate test instruments: including a test of gender and racial attitudes; measures of parent-child interactions (e.g. HOME), parent attitudes and beliefs and the preschool version of the mathematics assessment in the first grades (EGMA) (the EGMA has no cost of copyright). A questionnaire will also be used to collect information about: educational level of parents/guardians, and household characteristics.
- Recruit and train enumerators for data collection, entry, and coding of responses for data collectors
- Conduct test application in 536 community households (with 10 to 12 students per community household. The firm will be responsible for printing the questionnaires or provide tablets for electronic data entry.
- Conduct double entry of the collected data in STATA.
- To lay the basis for a possible longitudinal study in the future, the evaluation firm has to collect the following data: (i) names of all individuals must be recorded in separate columns for each name with up to 4 names per individual (if applicable) and with separate columns for surnames (name1, name2, Appellido1 and Appellido2); (ii) Phone numbers, social media contact (user names and Facebook, Twitter and Skype); (iii) Each participant should be asked how likely they are to move out of their current home and that primary and secondary school think their grandchildren will go; and (iv) at the time of the final line), the names must be verified against the original baseline to ensure that the spelling is consistent over the years.
- Maintain and provide a Fieldwork Diary in order to register incidents, logistical, transportation and any other data collection and entry related issues.

5. Expected Outcome and Deliverables

5.1. The consultancy will deliver the following documents and reports:

(i) Inception report, including work plan (Product 1);

(ii) Report on Training in data collection and entry (Product 2);

(iii) Report on Data collection, including supervision and quality control. The field work diary should be annexed (Product 3);

(iv) Report on Data entry, including supervision and quality control. The database should be provided in STATA or excel (Product 4).

6. Project Schedule and Milestones

6.1. Product #1: workplan of the consultancy, including the theoretical and methodological approach of the evaluation, describing the tests and instruments to be used, the calculations of power and the data to be collected for the evaluation, identifying the mechanism to Follow, those responsible and the frequency and form of presentation.

6.2. Product #2: The first quarterly progress report and validated instruments.

6.3. Product #3: The baseline database with its corresponding technical report and code Book and code book.

6.4. Product #4: The endline database with its corresponding technical report and code Book.

7. Reporting Requirements

7.1. The firm will be required to provide biweekly written updates on the progress of the work.

7.2. All materials produced during and for this consultancy will:

(i) be delivered in hard and electronic copies (Zip files won't be accepted as final reports):

(ii) be owned by the IDB (copyright), including the right to produce, distribute, disseminate and publish, notwithstanding the termination of the consultancy.

8. Acceptance Criteria

8.1. Surveys collected and coded should be subject to revisions and random checks by the firm to ensure the highest work ethic and data integrity. The quality control standards will be the standard protocols employed and required by the IDB and data collection firms.

9. Other Requirements

10. Supervision and Reporting

10.1. The consulting firm will be reporting to SCL/EDU, including participation in biweekly project meetings. All reports and databases will require approval by the IDB project team. It shall be Firm's responsibility for ensuring that all reports are submitted to the Bank.

10.2.

11. Schedule of Payments

11.1. Payments will be made as follows:

Payment Schedule	
Deliverable	**Percent**
1. Product 1	35%
2. Product 2	25%
3. Product 3	20%
4. Product 4	20%
TOTAL	100%

TERMS OF REFERENCE

Implementation of *Pequeñas Aventureras* Pilot

RG-T3155

Gender and Diversity in Science, Technology, Engineering, Art and Mathematics (STEAM)

1. Background and Justification

1.1. Established in 1959, the Inter-American Development Bank ("IDB " or "Bank ") is the main source of funding for economic, social and institutional development in Latin America and the Caribbean. The IDB provides loans, grants, guarantees, policy advice and technical assistance to the public and private sectors of the borrowing countries.

1.2. Results from international exams present alarming evidence about the state of girls' mathematics and science education in Latin America. On the 2015 Program for International Student Assessment (PISA) exam, all participating non-OECD Latin American countries produced gender gaps in favor of boys that were nearly double the OECD average (OECD, 2015). Additionally, most participating Latin American were in the bottom quartile of mathematics and science performance distribution, with at least one-third of those amongst the 10 worst performing nations. Given that these same countries also rank in the bottom quartile of the mathematics and science gender-gap distribution in favor of boys, it can be argued that Latin American girls are among the least proficient mathematics and science learners in the world (OECD 2016). These disparities translate into gender gaps in tertiary graduation rates, particularly in Engineering where women comprise 31.0% in Argentina, 29.5% in Brazil, 32.1% in Colombia, 33.7% in Costa Rica, and 26.6% in el Salvador. While these gaps are relatively narrow compared to other countries, including OECD countries, female participation rates in engineering and physical and computer sciences has declined consistently in the LAC region over the past decade, and especially so in the larger economies such as Argentina, Brazil, Chile, and Colombia. The only exception is Mexico, where participation rates have increased slightly (UNESCO 2015). Over the next decade, the generally decreasing proportion of economically active women compared to men – particularly in Science, Technology Engineering and Mathematics careers – is estimated estimated to suppress regional GDP growth by more than US$1 trillion (Cadena and MadGavkar, 2015).

1.3. A large body of literature indicates that the lack of women in Science, Technology Engineering and Mathematics careers has its roots in adverse feelings towards mathematics, which has been shown to negatively influence test performance and may also explain some of the gender disparity in mathematics proficiency in Latin America (Hembree 1990; Ma 1999; Ho et al 2000; Ashcraft and Krause 2007; Vukovic et al. 2012; Devine et al. 2012; Casad, Hale and Wachs 2015). Mathematics anxiety, or negative emotional associations with mathematics-related work, is theorized to interfere with working memory, and thus render necessary mathematics information inaccessible to students as they solve mathematics problems (Ashcraft and Krause 2007). Mathematics confidence and anxiety are also correlated with future participation in mathematics-related studies and careers. In a meta-analysis of 151 studies on the effects of mathematics anxiety, Hembree (1990) shows that students with higher levels of mathematics anxiety enrolled in fewer elective mathematics courses and expressed less interest in pursuing high-school and college mathematics.

1.4. On the 2012 PISA, students of both sexes from participating LAC countries reported higher levels of mathematics anxiety than their OECD peers, and in all these countries, female students reported experiences significantly higher levels of mathematics anxiety than their male peers (OECD, 2012). In other words, LAC girls are not only among the lowest performers in mathematics, but also experience some of the highest levels of mathematics anxiety in the world. Evidence suggests that these disparities may partially be influenced by gender differences in teacher or parent interactions with students, especially when those interactions reinforce gender stereotypes that boys are more suitable for mathematics than girls (Beilock & Maloney 2010; Hembree 1990). In other words, girls may be acquiring at least some of their mathematics anxiety from day-to-day interactions, and because mathematics anxiety effects learning, girls are, to some extent, disadvantaged by gender differences in socialization (Ashcraft & Kirk, 2001).

1.5. The gender gaps in Science, Technology Engineering and Mathematics learning and participation are even more prominent for afro-descendent and indigenous girls (Riegle-Crumb & Humphries, 2012; Atal, Nopo, & Winder, 2009). These gaps can depend on the specific population being considered, where males in patriarchal societies can vary somewhat on the intensity and characteristics of their beliefs regarding women as well as for how females view themselves (O'Brien, Blodorn, Adams, Hammer & Garcia, 2015). There has been little research regarding these variations in the Latin American and Caribbean afro-descendant and indigenous populations, and the dearth of knowledge regarding these topics potentially limits the impact of interventions as they fall short of addressing population specific needs. The little research available regarding these populations supports international findings by showing that the prevalence and intensity of gender and ethnic stereotypes may be population-dependent (Gonzalez, Blanton & Williams, 2002).

1.6. In response to these challenges, the IDB launched the Gender in Mathematics and Science Learning project (RG-T2589) in 2015 with the objective of developing a campaign and education materials to promote the importance of mathematics and science for girls and facilitate their participation in these subjects. This ambitious project produced significantly positive results; it created: (i) an innovative and research-based mathematics curriculum targeted to increase the appeal of mathematics for girls, (ii) 18 Pequeñas Aventureras webisodes in which Lola, a beloved puppet from the Sesame Workshop, interacted with female STEAM role-models, (iii) three public announcements featuring Lola from the Sesame Workshop to encourage participation in program content, (iv) social media content to promote gender equity in STEAM learning, (v) 5 E-books promoting themes associated with gender and STEAM learning and (vi) community outreach materials (www.iadb.org/matematicas). The campaign was launched in Mexico in 2017 in collaboration with the Office of the President. As regards the community materials, current trends suggest that by the end of 2018, nearly 40,000 children will have benefitted. The digital campaign has been incredibly successful as it has been accessed by close to 2 million people and received wide media coverage in over 30 digital and print platforms, potentially changing how young girls are socialized to think about STEAM learning.

1.7. To capitalize on the successes achieved so far, the Ministry of Education in Cali, Colombia, and the IDB have joined forces to implement an experimental pilot in Cali to evaluate the effectiveness of the materials developed within the framework of the RG-T2589 to promote the interest of girls of 4-5 years in mathematics and science.

1.8. Against this background, the IDB is looking to contract a firm to assist with the implementation of the pilot in Cali, Colombia.

2. Objectives

2.1. The objective of the consultancy is to train and coach community household educators and parents in the use of the Pequeñas Aventureras materials.

3. Scope of Services

3.1. The beneficiaries include 268 community household educators and parents from 134 households in Cali, Colombia.

4. Key Activities

4.1. The consulting firm will work in close collaboration with the Ministry of Education in Cali, conducting the following activities, without prejudice to other tasks that are necessary to complete the work:
4.2. Develop and submit a first draft of a detailed work plan for the consultancy, including the description of the activities to be carried out and its products, a schedule of activities and deliverables.
4.3. Development of two separate training programs for Community Household educators and parents, using the Pequeñas Aventureras materials. The materials will include: lesson plans for the training of educators; and educator guides. The training program should be design to be delivered to educators and parents through over a total of 50 training hours, including pull-out and classroom based training events.
4.4. Monitor the intensity of the use of Pequeñas Aventureras in Community Households.

5. Expected Outcome and Deliverables

5.1. The consultancy will deliver the following documents and reports:
(i) Inception report, including work plan (Product 1);
(ii) Report on the initial training of community household educators and parents (Product 2);
(iii) Report on the continuous training and coaching of community household educators and parents (Product 3);
(iv) Final report on the implementation of the pilot, including a database on the intensity of the treatment (# of training hours attended by beneficiary, and Pequenas Aventureras materials used in th classroom or home) (Product 4).

6. Project Schedule and Milestones

6.1. Product #1: workplan of the consultancy, including the dates and responsibilities ofr training and coaching.
6.2. Product #2: The first quarterly progress report.
6.3. Product #3: The second quarterly report.
6.4. Product #4: The final report.

7. Reporting Requirements

11.2. The firm will be required to provide biweekly written updates on the progress of the work.

11.3. All materials produced during and for this consultancy will:

(i) be delivered in hard and electronic copies (Zip files won't be accepted as final reports):

(ii) be owned by the IDB (copyright), including the right to produce, distribute, disseminate and publish, notwithstanding the termination of the consultancy.

8. Acceptance Criteria

8.1. The training and coaching should be subject to revisions and random checks by the firm in order to ensure consistent high quality implementation.

9. Other Requirements

9.1. n/a

10. Supervision and Reporting

10.1. The consulting firm will be reporting to SCL/EDU, including participation in biweekly project meetings. All reports and databases will require approval by the IDB project team. It shall be Firm's responsibility for ensuring that all reports are submitted to the Bank.

11. Schedule of Payments

11.4. Payments will be made as follows:

Payment Schedule	
Deliverable	**Percent**
1. Product 1	35%
2. Product 2	25%
3. Product 3	20%
4. Product 4	20%
TOTAL	100%

TERMS OF REFERENCE

Design of Materials for Pequeñas Aventureras Pilot

RG-T3155

Gender and Diversity in Science, Technology, Engineering, Art and Mathematics (STEAM)

1. Background and Justification

1.1. Established in 1959, the Inter-American Development Bank ("IDB " or "Bank ") is the main source of funding for economic, social and institutional development in Latin America and the Caribbean. The IDB provides loans, grants, guarantees, policy advice and technical assistance to the public and private sectors of the borrowing countries.

1.2. Results from international exams present alarming evidence about the state of girls' mathematics and science education in Latin America. On the 2015 Program for International Student Assessment (PISA) exam, all participating non-OECD Latin American countries produced gender gaps in favor of boys that were nearly double the OECD average (OECD, 2015). Additionally, most participating Latin American were in the bottom quartile of mathematics and science performance distribution, with at least one-third of those amongst the 10 worst performing nations. Given that these same countries also rank in the bottom quartile of the mathematics and science gender-gap distribution in favor of boys, it can be argued that Latin American girls are among the least proficient mathematics and science learners in the world (OECD 2016). These disparities translate into gender gaps in tertiary graduation rates, particularly in Engineering where women comprise 31.0% in Argentina, 29.5% in Brazil, 32.1% in Colombia, 33.7% in Costa Rica, and 26.6% in el Salvador. While these gaps are relatively narrow compared to other countries, including OECD countries, female participation rates in engineering and physical and computer sciences has declined consistently in the LAC region over the past decade, and especially so in the larger economies such as Argentina, Brazil, Chile, and Colombia. The only exception is Mexico, where participation rates have increased slightly (UNESCO 2015). Over the next decade, the generally decreasing proportion of economically active women compared to men – particularly in Science, Technology Engineering and Mathematics careers – is estimated estimated to suppress regional GDP growth by more than US$1 trillion (Cadena and MadGavkar, 2015).

1.3. A large body of literature indicates that the lack of women in Science, Technology Engineering and Mathematics careers has its roots in adverse feelings towards mathematics, which has been shown to negatively influence test performance and may also explain some of the gender disparity in mathematics proficiency in Latin America (Hembree 1990; Ma 1999; Ho et al 2000; Ashcraft and Krause 2007; Vukovic et al. 2012; Devine et al. 2012; Casad, Hale and Wachs 2015). Mathematics anxiety, or negative emotional associations with mathematics-related work, is theorized to interfere with working memory, and thus render necessary mathematics information inaccessible to students as they solve mathematics problems (Ashcraft and Krause 2007). Mathematics confidence and anxiety are also correlated with future participation in mathematics-related studies and careers. In a meta-analysis of 151 studies on the effects of mathematics anxiety, Hembree (1990) shows that students with higher levels of mathematics anxiety enrolled in fewer elective mathematics courses and expressed less interest in pursuing high-school and college mathematics.

1.4. On the 2012 PISA, students of both sexes from participating LAC countries reported higher levels of mathematics anxiety than their OECD peers, and in all these countries, female students

reported experiences significantly higher levels of mathematics anxiety than their male peers (OECD, 2012). In other words, LAC girls are not only among the lowest performers in mathematics, but also experience some of the highest levels of mathematics anxiety in the world. Evidence suggests that these disparities may partially be influenced by gender differences in teacher or parent interactions with students, especially when those interactions reinforce gender stereotypes that boys are more suitable for mathematics than girls (Beilock & Maloney 2010; Hembree 1990). In other words, girls may be acquiring at least some of their mathematics anxiety from day-to-day interactions, and because mathematics anxiety effects learning, girls are, to some extent, disadvantaged by gender differences in socialization (Ashcraft & Kirk, 2001).

1.5. The gender gaps in Science, Technology Engineering and Mathematics learning and participation are even more prominent for afro-descendent and indigenous girls (Riegle-Crumb & Humphries, 2012; Atal, Nopo, & Winder, 2009). These gaps can depend on the specific population being considered, where males in patriarchal societies can vary somewhat on the intensity and characteristics of their beliefs regarding women as well as for how females view themselves (O'Brien, Blodorn, Adams, Hammer & Garcia, 2015). There has been little research regarding these variations in the Latin American and Caribbean afro-descendant and indigenous populations, and the dearth of knowledge regarding these topics potentially limits the impact of interventions as they fall short of addressing population specific needs. The little research available regarding these populations supports international findings by showing that the prevalence and intensity of gender and ethnic stereotypes may be population-dependent (Gonzalez, Blanton & Williams, 2002).

1.6. In response to these challenges, the IDB launched the Gender in Mathematics and Science Learning project (RG-T2589) in 2015 with the objective of developing a campaign and education materials to promote the importance of mathematics and science for girls and facilitate their participation in these subjects. This ambitious project produced significantly positive results; it created: (i) an innovative and research-based mathematics curriculum targeted to increase the appeal of mathematics for girls, (ii) 18 Pequeñas Aventureras webisodes in which Lola, a beloved puppet from the Sesame Workshop, interacted with female STEAM role-models, (iii) three public announcements featuring Lola from the Sesame Workshop to encourage participation in program content, (iv) social media content to promote gender equity in STEAM learning, (v) 5 E-books promoting themes associated with gender and STEAM learning and (vi) community outreach materials (www.iadb.org/matematicas). The campaign was launched in Mexico in 2017 in collaboration with the Office of the President. As regards the community materials, current trends suggest that by the end of 2018, nearly 40,000 children will have benefitted. The digital campaign has been incredibly successful as it has been accessed by close to 2 million people and received wide media coverage in over 30 digital and print platforms, potentially changing how young girls are socialized to think about STEAM learning.

1.7. To capitalize on the successes achieved so far, the Ministry of Education in Cali, Colombia, and the IDB have joined forces to implement an experimental pilot in Cali to evaluate the effectiveness of the materials developed within the framework of the RG-T2589 to promote the interest of girls of 4-5 years in mathematics and science.

1.8. Against this background, the IDB is looking to contract a firm to assist with the design of Pequeñas Aventureras materials about diversity, including afro-decedents and indigenous populations.

2. Objectives

2.1. The objective of the consultancy is to design complementary Pequeñas Aventureras materials that emphasize diversity and STEAM and do Sesame muppet appearances for the beneficiaries.

3. Scope of Services

3.1. The beneficiaries include 268 community household educators and parents from 134 households in Cali, Colombia.

4. Key Activities

4.1. The consulting firm will work in close collaboration with the Ministry of Education in Cali, conducting the following activities, without prejudice to other tasks that are necessary to complete the work:

(i) Develop and submit a first draft of a detailed work plan for the consultancy, including the description of the activities to be carried out and its products, a schedule of activities and deliverables.

(ii) Development complementary Pequeñas Aventureras materials to emphasize that any racial or ethnic group belongs in and can make important contributions in STEAM. The materials will include 3 lesson plans with activities; and one ebook

(iii) Make 10 muppet education appearances for beneficiaries.

5. Expected Outcome and Deliverables

5.1. The consultancy will deliver the following documents and reports:

(i) Inception report, including work plan (Product 1);

(ii) Report on the materials developed, including the materials as annexes (Product 2);

(iii) Report on the muppet education apperances(Product 3);

(iv) Final report on the implementation of the consultancy (Product 4).

6. Project Schedule and Milestones

6.1. Product #1: workplan of the consultancy.
6.2. Product #2: report and training materials.
6.3. Product #3: Report on muppet appearances.
6.4. Product #4: The final report.

7. Reporting Requirements

11.5. The firm will be required to provide biweekly email updates on the progress of the work. All materials produced during and for this consultancy will:

(i) be delivered in hard and electronic copies (Zip files won't be accepted as final reports):

(ii) be owned by the IDB (copyright), including the right to produce, distribute, disseminate and publish, notwithstanding the termination of the consultancy.

8. Acceptance Criteria

8.1. The training and coaching should be subject to revisions and random checks by the firm in order to ensure consistent high quality implementation.

9. Other Requirements

9.1. n/a

10. Supervision and Reporting

10.1. The consulting firm will be reporting to SCL/EDU, including participation in biweekly project meetings. All reports and databases will require approval by the IDB project team. It shall be Firm's responsibility for ensuring that all reports are submitted to the Bank.

11. Schedule of Payments

11.6. Payments will be made as follows:

Payment Schedule	
Deliverable	**Percent**
5. Product 1	35%
6. Product 2	25%
7. Product 3	20%
8. Product 4	20%
TOTAL	100%

TERMS OF REFERENCE

Individual Consultant for Social Network Analysis

RG-T3155

Gender and Diversity in Science, Technology, Engineering, Art and Mathematics (STEAM)

1. Background and Justification

1.1. Established in 1959, the Inter-American Development Bank ("IDB " or "Bank ") is the main source of funding for economic, social and institutional development in Latin America and the Caribbean. The IDB provides loans, grants, guarantees, policy advice and technical assistance to the public and private sectors of the borrowing countries.

1.2. Results from international exams present alarming evidence about the state of girls' mathematics and science education in Latin America. On the 2015 Program for International Student Assessment (PISA) exam, all participating non-OECD Latin American countries produced gender gaps in favor of boys that were nearly double the OECD average (OECD, 2015). Additionally, most participating Latin American were in the bottom quartile of mathematics and science performance distribution, with at least one-third of those amongst the 10 worst performing nations. Given that these same countries also rank in the bottom quartile of the mathematics and science gender-gap distribution in favor of boys, it can be argued that Latin American girls are among the least proficient mathematics and science learners in the world (OECD 2016). These disparities translate into gender gaps in tertiary graduation rates, particularly in Engineering where women comprise 31.0% in Argentina, 29.5% in Brazil, 32.1% in Colombia, 33.7% in Costa Rica, and 26.6% in el Salvador. While these gaps are relatively narrow compared to other countries, including OECD countries, female participation rates in engineering and physical and computer sciences has declined consistently in the LAC region over the past decade, and especially so in the larger economies such as Argentina, Brazil, Chile, and Colombia. The only exception is Mexico, where participation rates have increased slightly (UNESCO 2015). Over the next decade, the generally decreasing proportion of economically active women compared to men – particularly in Science, Technology Engineering and Mathematics careers – is estimated estimated to suppress regional GDP growth by more than US$1 trillion (Cadena and MadGavkar, 2015).

1.3. A large body of literature indicates that the lack of women in Science, Technology Engineering and Mathematics careers has its roots in adverse feelings towards mathematics, which has been shown to negatively influence test performance and may also explain some of the gender disparity in mathematics proficiency in Latin America (Hembree 1990; Ma 1999; Ho et al 2000; Ashcraft and Krause 2007; Vukovic et al. 2012; Devine et al. 2012; Casad, Hale and Wachs 2015). Mathematics anxiety, or negative emotional associations with mathematics-related work, is theorized to interfere with working memory, and thus render necessary mathematics information inaccessible to students as they solve mathematics problems (Ashcraft and Krause 2007). Mathematics confidence and anxiety are also correlated with future participation in mathematics-related studies and careers. In a meta-analysis of 151 studies on the effects of mathematics anxiety, Hembree (1990) shows that students with higher levels of mathematics anxiety enrolled in fewer elective mathematics courses and expressed less interest in pursuing high-school and college mathematics.

1.4. On the 2012 PISA, students of both sexes from participating LAC countries reported higher levels of mathematics anxiety than their OECD peers, and in all these countries, female students reported experiences significantly higher levels of mathematics anxiety than their male peers (OECD, 2012). In other words, LAC girls are not only among the lowest performers in mathematics, but also experience some of the highest levels of mathematics anxiety in the world. Evidence suggests that these disparities may partially be influenced by gender differences in teacher or parent interactions with students, especially when those interactions reinforce gender stereotypes that boys are more suitable for mathematics than girls (Beilock & Maloney 2010; Hembree 1990). In other words, girls may be acquiring at least some of their mathematics anxiety from day-to-day interactions, and because mathematics anxiety effects learning, girls are, to some extent, disadvantaged by gender differences in socialization (Ashcraft & Kirk, 2001).

1.5. The gender gaps in Science, Technology Engineering and Mathematics learning and participation are even more prominent for afro-descendent and indigenous girls (Riegle-Crumb & Humphries, 2012; Atal, Nopo, & Winder, 2009). These gaps can depend on the specific population being considered, where males in patriarchal societies can vary somewhat on the intensity and characteristics of their beliefs regarding women as well as for how females view themselves (O'Brien, Blodorn, Adams, Hammer & Garcia, 2015). There has been little research regarding these variations in the Latin American and Caribbean afro-descendant and indigenous populations, and the dearth of knowledge regarding these topics potentially limits the impact of interventions as they fall short of addressing population specific needs. The little research available regarding these populations supports international findings by showing that the prevalence and intensity of gender and ethnic stereotypes may be population-dependent (Gonzalez, Blanton & Williams, 2002).

1.6. In response to these challenges, the IDB launched the Gender in Mathematics and Science Learning project (RG-T2589) in 2015. One objective of the Gender in Mathematics and Science Learning project was to finance a Big Data analysis of Social Network discourse regarding Science, Technology Engineering and Mathematics throughout Latin America. The analysis revealed that gender stereotypes are prevalent in Latin American social media and that girls and young women are more likely than male social media users to post and feel affinity to posts that promote negative views of Science, Technology Engineering and Mathematics subjects. Furthermore, the analysis showed that women's participation in Science, Technology Engineering and Mathematics careers is largely invisible in science and engineering articles shared in Latin America social media platforms. The only positive mentions of girls and women in Science, Technology Engineering and Mathematics originate from networks specifically dedicated to gender equality in STEAM, and there is an overrepresentation of male lead researchers and scientists in social media images and mentions of Science, Technology Engineering and Mathematics discoveries and innovations.

1.7. To capitalize on the successes achieved so far and deepen the understanding of the social determinants of gender inequality in STEAM participation, the IDB will conduct research based on big data computational techniques to continue the line of investigation initiated under RG-T2589 to explore the tone of the Science, Technology Engineering and Mathematics discourse and the extent of gender-based stereotypes amongst Latin American social media users. Results from this project will guide future education program design to help increase exposure to diverse role-models and girls' participation in STEAM education. Against this background, the IDB is looking to contract an individual consultant to assist with the analysis.

2. Objectives

2.1. Given the associations between stereotypes, attitudes, performance and participation, as well as contextual variations in the intensity of mathematics anxiety and science self-efficacy, the aim of the consultancy is to conduct an international comparative analysis of social media STEM discourse between countries with high and low gender equality in STEM.

3. Scope of Services

3.1. The study should encompass Argentina, Costa Rica, Chile, Uruguay, Colombia and Brazil; and as comparison countries Finland, Singapore and Sweden. STEM social media posts should be harvested from the main social media networks (twitter and Facebook) for a period of 8 weeks.

4. Key Activities

4.1. The consultant will collaborate with the IDB team to observe how the manifestation of STEM stereotypes in social media activities correlate with gender gaps in PISA mathematics and science performance and STEM career participation rates. In doing so, the consultant should seek to build on results from Naslund-Hadley and others (in review) which showed that that female users were three times more self-deprecating regarding their STEM proficiency and that there were six times fewer shares of Science news portraying a female STEM role-model than a male one. The consultant should expand on these results by i) including countries with high measures of gender STEM equality and ii) enhancing the algorithm to include more STEM related terms.

4.2. The study should answer questions such as:

- What is the intensity, frequency and tone of gender stereotype regarding STEM in social network discourse/activity of LAC countries with low levels of gender equality in STEM?
- What is the intensity, frequency and tone of gender stereotype regarding STEM in social network discourse/activity of non-LAC countries with high levels of gender equality in STEM?
- What are the differences in intensity, frequency and tone of gender stereotypes in social network discourse/activity regarding STEM between LAC/low-equality and non-LAC/high-equality in STEM?
- How do males and females interact differently in STEM discourse, and do those interactions change between countries with high and low gender equality in STEM?
- Do those differences change depending on the user development level (adolescents vs. adults)?
- Is there a difference in gender distribution of STEM role-models in science news between countries with low and high gender equality in STEM?
- Is there a difference in the number or tone of comments in STEM news articles depending on the gender of the scientist or author?
- Is there a difference in reach of activity supporting women in STEM between countries with high and low gender equality in STEM outcomes?
- Is there a difference in number/member size of gender/STEM networks between countries with high and low gender equality in STEM?

- Is a country's level of gender equality in STEM associated with successful Girls in STEM campaigns as determined by the capacity of their activity to reach users outside explicit Gender and STEM networks?

5. Expected Outcome and Deliverables

The consultancy will deliver the following documents and reports:

(i) Inception report, including work plan and research design (Product 1);
(ii) First progress report, including a description of the data harvesting (Product 2);
(iii) Second progress report, including the identification of communities and initial analysis of the findings (Product 3);
(iv) Final report and data in Hadoop with codebook (Product 4).

6. Project Schedule and Milestones

6.1. Product #1: workplan of the consultancy, including the theoretical and methodological approach.
6.2. Product #2: The first progress report and validated instruments.
6.3. Product #3: The second progress report.
6.4. Product #4: The final report and database.

7. Reporting Requirements

7.1. The firm will be required to provide biweekly written updates on the progress of the work. All materials produced during and for this consultancy will:

(i) be delivered in hard and electronic copies (Zip files won't be accepted as final reports):
(ii) be owned by the IDB (copyright), including the right to produce, distribute, disseminate and publish, notwithstanding the termination of the consultancy.

8. Acceptance Criteria

8.1 The quality control standards will be consistent with those employed in academia for big data analysis.

9. Other Requirements

9.1. Education: PhD degree or equivalent in statistics, economics, or a related field,
9.2. Experience: Five years of experience
9.3. Languages: The consultant must have excellent command of English. Spanish is preferred.

10. Supervision and Reporting

10.1. The consulting firm will be reporting to SCL/EDU, including participation in biweekly project meetings. All reports and databases will require approval by the IDB project team. It shall be Firm's responsibility for ensuring that all reports are submitted to the Bank.

11. Schedule of Payments

1.1. Payments will be made as follows:

Payment Schedule	
Deliverable	**Percent**
1. Product 1	35%
2. Product 2	25%
3. Product 3	20%
4. Product 4	20%
TOTAL	100%

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TERMS OF REFERENCE

Individual Consultant to Assist with Analysis of Experimental Data for Pequeñas Aventureras Pilot

RG-T3155

Gender and Diversity in Science, Technology, Engineering, Art and Mathematics (STEAM)

1. Background and Justification

1.1. Established in 1959, the Inter-American Development Bank ("IDB " or "Bank ") is the main source of funding for economic, social and institutional development in Latin America and the Caribbean. The IDB provides loans, grants, guarantees, policy advice and technical assistance to the public and private sectors of the borrowing countries.

1.2. Results from international exams present alarming evidence about the state of girls' mathematics and science education in Latin America. On the 2015 Program for International Student Assessment (PISA) exam, all participating non-OECD Latin American countries produced gender gaps in favor of boys that were nearly double the OECD average (OECD, 2015). Additionally, most participating Latin American were in the bottom quartile of mathematics and science performance distribution, with at least one-third of those amongst the 10 worst performing nations. Given that these same countries also rank in the bottom quartile of the mathematics and science gender-gap distribution in favor of boys, it can be argued that Latin American girls are among the least proficient mathematics and science learners in the world (OECD 2016). These disparities translate into gender gaps in tertiary graduation rates, particularly in Engineering where women comprise 31.0% in Argentina, 29.5% in Brazil, 32.1% in Colombia, 33.7% in Costa Rica, and 26.6% in el Salvador. While these gaps are relatively narrow compared to other countries, including OECD countries, female participation rates in engineering and physical and computer sciences has declined consistently in the LAC region over the past decade, and especially so in the larger economies such as Argentina, Brazil, Chile, and Colombia. The only exception is Mexico, where participation rates have increased slightly (UNESCO 2015). Over the next decade, the generally decreasing proportion of economically active women compared to men – particularly in Science, Technology Engineering and Mathematics careers – is estimated estimated to suppress regional GDP growth by more than US$1 trillion (Cadena and MadGavkar, 2015).

1.3. A large body of literature indicates that the lack of women in Science, Technology Engineering and Mathematics careers has its roots in adverse feelings towards mathematics, which has been shown to negatively influence test performance and may also explain some of the gender disparity in mathematics proficiency in Latin America (Hembree 1990; Ma 1999; Ho et al 2000; Ashcraft and Krause 2007; Vukovic et al. 2012; Devine et al. 2012; Casad, Hale and Wachs 2015). Mathematics anxiety, or negative emotional associations with mathematics-related work, is theorized to interfere with working memory, and thus render necessary mathematics information inaccessible to students as they solve mathematics problems (Ashcraft and Krause 2007). Mathematics confidence and anxiety are also correlated with future participation in mathematics-related studies and careers. In a meta-analysis of 151 studies on the effects of mathematics anxiety, Hembree (1990) shows that students with higher levels of mathematics anxiety enrolled in fewer elective mathematics courses and expressed less interest in pursuing high-school and college mathematics.

1.4. On the 2012 PISA, students of both sexes from participating LAC countries reported higher levels of mathematics anxiety than their OECD peers, and in all these countries, female students reported experiences significantly higher levels of mathematics anxiety than their male peers (OECD, 2012). In other words, LAC girls are not only among the lowest performers in mathematics, but also experience some of the highest levels of mathematics anxiety in the world. Evidence suggests that these disparities may partially be influenced by gender differences in teacher or parent interactions with students, especially when those interactions reinforce gender stereotypes that boys are more suitable for mathematics than girls (Beilock & Maloney 2010; Hembree 1990). In other words, girls may be acquiring at least some of their mathematics anxiety from day-to-day interactions, and because mathematics anxiety effects learning, girls are, to some extent, disadvantaged by gender differences in socialization (Ashcraft & Kirk, 2001).

1.5. The gender gaps in Science, Technology Engineering and Mathematics learning and participation are even more prominent for afro-descendent and indigenous girls (Riegle-Crumb & Humphries, 2012; Atal, Nopo, & Winder, 2009). These gaps can depend on the specific population being considered, where males in patriarchal societies can vary somewhat on the intensity and characteristics of their beliefs regarding women as well as for how females view themselves (O'Brien, Blodorn, Adams, Hammer & Garcia, 2015). There has been little research regarding these variations in the Latin American and Caribbean afro-descendant and indigenous populations, and the dearth of knowledge regarding these topics potentially limits the impact of interventions as they fall short of addressing population specific needs. The little research available regarding these populations supports international findings by showing that the prevalence and intensity of gender and ethnic stereotypes may be population-dependent (Gonzalez, Blanton & Williams, 2002).

1.6. In response to these challenges, the IDB launched the Gender in Mathematics and Science Learning project (RG-T2589) in 2015 with the objective of developing a campaign and education materials to promote the importance of mathematics and science for girls and facilitate their participation in these subjects. This ambitious project produced significantly positive results; it created: (i) an innovative and research-based mathematics curriculum targeted to increase the appeal of mathematics for girls, (ii) 18 Pequeñas Aventureras webisodes in which Lola, a beloved puppet from the Sesame Workshop, interacted with female STEAM role-models, (iii) three public announcements featuring Lola from the Sesame Workshop to encourage participation in program content, (iv) social media content to promote gender equity in STEAM learning, (v) 5 E-books promoting themes associated with gender and STEAM learning and (vi) community outreach materials (www.iadb.org/matematicas). The campaign was launched in Mexico in 2017 in collaboration with the Office of the President. As regards the community materials, current trends suggest that by the end of 2018, nearly 40,000 children will have benefitted. The digital campaign has been incredibly successful as it has been accessed by close to 2 million people and received wide media coverage in over 30 digital and print platforms, potentially changing how young girls are socialized to think about STEAM learning.

1.7. To capitalize on the successes achieved so far, the Ministry of Education in Cali, Colombia, and the IDB have joined forces to implement an experimental pilot in Cali to evaluate the effectiveness of the materials developed within the framework of the RG-T2589 to promote the interest of girls of 4-5 years in mathematics and science.

1.8. Against this background, the IDB is looking to contract an individual to assist with the experimental evaluation of the pilot, including data analysis.

2. Objectives

2.1. The objective of this consultancy is to provide statistical and research support for the impact assessment of the pilot project "Pequeñas Aventureras" in Cali, Colombia.

3. Scope of Services

3.1. The scope of the consultancy is 7 months full time.

4. Key Activities

4.1. The key activities include, but are not limited to the following:

(i) Assist in database management of experimental results, using STATA to merge and clean large datasets

(ii) Conduct statistical analysis of sample diagnostic and post-treatment characteristics, including checking for experimental group balance, attrition, regression assumptions and experimental effects.

(iii) Conduct literature review of related studies and theories to contextualize the relevance of this study

(iv) Describe methodology and implementation proceedings in the execution of contract terms, with attention to implementation events that are important in interpreting final results.

(v) Write an analytical report of implementation and treatment results, incorporating quantitative and qualitative results to clarify the use and effect of treatment.

(vi) Incorporate feedback into subsequent versions of the analysis throughout the publication process.

5. Expected Outcome and Deliverables

5.1. The consultancy will deliver the following documents and reports:

(i) Cleaned Database in STATA (Product 1);

(ii) Initial analyses of data (Product 2);

(iii) Draft academic paper (Product 3).

6. Project Schedule and Milestones

6.1. Product #1: Database
6.2. Product #2: Initial analysis of data including dofiles.
6.3. Product #3: Draft academic paper.

7. Reporting Requirements

7.1. The individual consultant will work in close coordination with the IDB Project TEAM and participate in weekly meetings.

8. Other Requirements

8.1. Education: Master's degree or equivalent in statistics, education, public policy, social sciences, economics, or a related field,
8.2. Experience: Two years of experience
8.3. Languages: The consultant must have excellent command of English. Spanish is preferred.

9. Supervision and Reporting

9.1. The consultant will be reporting to SCL/EDU, including participation in biweekly project meetings. All reports and databases will require approval by the IDB project team.

10. Schedule of Payments

10.1. Bimonthly payments

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PROCUREMENT PLAN FOR IDB-EXECUTED OPERATIONS

Country: Regional | **Executing Agency: IDB** | **UDR: SCL/EDU**

Project number: RG-T3155 | **Project name: Gender and Diversity in Science, Technology, Engineering, Art, and Mathematics (STEAM)**

Period covered by the Plan: 18 months | **Total Project Amount:** $ 300,000

Component	Procurement Type (1) (2)	Service type (1) (2)	Description	Estimated contract cost (US$)	Selection Method (2)	Type of Contract	Source of Financing and Percentage				Estimated date of the procurement notice	Estimated contract start date	Estimated contract length	Comments
							IDB/MIF		Other External Donor					
							Amount	%	Amount	%				
Component 1	A. Consulting services	Consulting Firm (GN-2765)	Consultant 1 Development of Treatment and materials and muppet appearances	$ 40,000	SSS	Lump Sum	$ 40,000	100%	$ -	0%	20-Jul-18	25-Aug-18	18 months	
Component 1	A. Consulting services	Consulting Firm (GN-2765)	Consultant 2 Coordinacion Fundacion Carvajal	$ 50,000	SSS	Lump Sum	$ 30,000	100%		0%	20-Jul-18	20-Mar-18	18 months	
Component 2	A. Consulting services	Consulting Firm (GN-2765)	Consultant 3: Baseline and Endline	$ 160,000	ICQ	Lump Sum	$ 180,000	100%		0%	20-Jul-18	25/9/2018	18 months	
Component 2	A. Consulting services	Individual Consultant (AM-650)	Consultant 4: Analysis RCT	$ 20,000	ICQ	Lump Sum	$ 20,000	100%		0%	10-May-19	10-Dec-19	7 months	
Component 3	A. Consulting services	Individual Consultant (AM-650)	Consultant 5: Big data analysis	$ 30,000	ICQ	Lump Sum	$ 30,000	100%		0%	20-Sep-18	25-Mar-19	6 months	
Prepared by:			**TOTALS**	**$ 300,000**			**$ 300,000**	**100%**	**$ -**	**0%**				

(1) Grouping together of similar procurement is recommended, such as publications, travel, etc. If there are a number of similar individual contracts to be executed at different times, they can be grouped together under a single heading with an explanation in the comments column indicating the average individual amount and the period during which the contract would be executed. For example: an export promotion project that includes travel to participate in fairs would have an item called "airfare for fairs", an estimated total value od US$5,000, and an explanation in the Comments column: "This is for approximately four different airfares to participate in fairs in the region in years X and X1".

(2) (i) Individual consultants: ICQ: Individual Consultant Selection Based on Qualifications; SSS: Single Source Selection. Selection process to be done in accordance with AM-650.

(2) (ii) Consulting firms: Per GN-2765-1, Consulting Firm selection methods for Bank-executed Operations are: Single Source Selection (SSS); Simplified Competitive Selection (<=250K) (SCS); Fully Competitive (>250K) (FCS); and Framework Agreement Task Order (TO). All Consulting Firm selection processes under this policy must use the electronic module in Convergence.

(2) (iii) Goods: Per GN-2765-1, par. A.2.2.c: "The procurement of goods and related services, except when such goods and related services are necessary to achieve the objectives of the Bank-executed Operational Work and are included in the consulting services contract and represent less than ten percent (10%) of the consulting services contract value."

Power Calculation RG-T3155

Inputs							Result
P	N	J	n	rho	c	s	MDE
0.5	6,000	600	10	0.10	1	0	0.10
0.5	8,800	880	10	0.20	1	0	0.10
0.5	2,680	268	10	0.10	1	0	0.15
0.5	3,930	393	10	0.20	1	0	0.15
0.5	1,520	152	10	0.10	1	0	0.20
0.5	2,220	222	10	0.20	1	0	0.20

P: Probability of treatment; N: total number of observations; J: number of community households; n: average number of observations per community households; rho: intra-community household correlation; c: % of observations T that were T; s: % of observations in group C that were T.