**STEM Gender Inequity in Chile**

**A systematic look**

**Oxford Global Challenge**

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**Introduction**

Global gender inequality is the social problem of our time in countries across the world. Both men and women are affected by gender norms, but women and girls tend to end in a position of socioeconomic disadvantage. Women in most countries earn on average 60 to 75 per cent of men’s wages. They are likely to perform unpaid jobs; engage in low-productivity and informal activities (UN Women). Over half of children out of school are girls. Less than 40% of countries provide girls and boys with equal access to education. Women are underrepresented in scientific and technological disciplines. Only 17 women have won a Nobel Prize in physics, chemistry or medicine, compared to 572 men. Today, only 28% of all of the world’s researchers are women (UNESCO, 2017). There is an international consensus in regards to giving better opportunities to girls and women; for normative reasons and economic enhancement.

This report will specifically zoom into lack of gender diversity in STEM (Scientific, Technology, Engineering and Mathematics) careers in Chile. Chile has the lowest female graduation rate on STEM-related areas (19%) and presents one of the highest gender gaps on math and science performance among OECD countries. STEM career participation is relevant since it is associated to higher payments. This report will look into STEM unequal career participation, Higher Education enrolment and STEM-related educational results – such as math and science performance. The latter is relevant since math and science admission tests performance are key to access STEM studies in universities, and this is where boys tend to outperform girls.

According to our research, the socialization process happening in different levels is directly linked with preferences and abilities children can have towards STEM related subjects. There has been a powerful socialization process in which math and science have been defined as masculine areas. The latter invites us to look into the problem and opportunities to create change.

**Focusing locally, observing globally**

We are focusing in STEM and Chile, but include a look into international evidence[[1]](#footnote-1). We have conducted desktop research and action-research with a diverse set of sources: Interviews with principals and teachers, meetings and email exchange with solution-landscape actors, articles, seminaries, documentaries, reports and books.

According to our analysis, main actors are the individuals (students, children) who are positioned in different levels: households (families), schools (teachers, principals), universities and labour market. In the solution mapping, these actors are interlocked with initiatives coming from the Third Sector (NGOs, Non-profit institutions or charities), Educational Sector (Schools or Universities) Government and Private Sector.

***Mapping STEM and Gender in Chile***

**Private Sector**

* **Companies**

**Third Sector**

* **NGOs**
* **Non-for profit**
* **Charities**

**Educational Sector**

* **School Initiatives**
* **Faculties initiatives**
* **Academia (Research)**

**Government**

* **Ministries**
* **Reports**
* **Public Policy**

Actors identified for levels of the problem

**INTERACTIONS AND GAPS**

Actors identified for levels of solution

1. **CHALLENGE MAPPING: The problem**

There is a lack of gender diversity on STEM careers globally and in Chile. Women tend to participate less on STEM courses on Higher Education. A key factor to access STEM studies in Chilean universities is PSU[[2]](#footnote-2) Math score. Evidence has shown significant gender disparities on maths where girls tend to get lower results.

Part of this gap is produced by gender stereotypes, reproduced in school and household. Parents and teachers are especially key in the formation of self-concept, attitudes and skills. They have little knowledge about this problem and feed gender stereotypes unconsciously.

**What happens in Households and at the Individual Level?**

International evidence[[3]](#footnote-3) shows:

* In the US, parent’s expectations for children’s math abilities are gender biased. This has an influence their attitude and performance.
* In Singapore, boys show a stronger math self-concept while girls tend to show a weaker one. These are linked to math achievement.

Recent evidence in Chile shows:

* Children and parents present a stereotype that associates mathematics with masculinity.
* PISA test survey shows that parents hold higher expectations for boys to study STEM related careers.
* When interviewing principals and teachers, they commented on how these stereotypes come strongly marked from student’s homes.

**What happens at the School and classroom level?**

International evidence shows:

* In the US, teachers show higher expectations for boys in comparison to girls for math attitudes and abilities. Girls tend to show mathematic anxiety and less self-efficacy.

Recent evidence in Chile shows:

* Kindergarten educators present a stereotype that associates mathematics with masculinity.
* Teachers ask more complex questions and interact more with boys than girls in math class.
* Undergraduates preparing to be teachers show higher expectations for boys than for girls in math.

**What happens with STEM-related performance, like Math and Science tests results?**

* PISA test (2015) shows that 16 countries present a significant difference in science with boys outperforming girls. 18 countries show significant statistic difference in Math. Latin America region presents the highest gender gaps and Chile presents the third largest gender gap in math performance among OECD countries.
* Chilean standardized tests on math shows that there are no significant differences in primary education. On secondary education the math results gap between boys and girls starts to show. In PSU math and science tests, gender gaps have remained between 20 and 30 points in favour to men for the last decade.

**What happens at Higher Education?**

* Globally, women represent only 35% of all students enrolled in STEM-related fields of study.
* In Chile, women represent only 20% of students enrolled in STEM-related fields of study, even when they represent 60% of Higher Education enrolment.
* Only 19% of total STEM graduates in Chile are women; the lowest among OECD countries.

**What happens at the labour market?**

* Across regions, women count as less than third (28.8%) of those employed in scientific research and development.
* Women are less likely to enter and more likely to leave STEM careers (53% of women stop working on tech-intensive industries versus 31% men).
* In Chile, only 28% of those who choose to undertake a science-researcher career are women. According to CEPAL (2014), reasons are related to the difficult work and family conciliation, male-dominated areas that don’t value knowledge shared by women, and permanence of gender stereotypes rooted in the community.
1. **SOLUTIONS MAPPING**

**Household and Individual Level**

Few to none initiatives are working directly with households to change their perceptions and support them to realise the impact unconscious stereotyping can have on girls’ achievement and aspirations. Government and Third Sector have created few national campaigns through media where the message is to rethink gender stereotyped roles.

**Solutions to address gender inequality in STEM at School**

 ***Government:*** Gender Equity unit members explained that they have developed class-observation instruments to help teachers to measure whether they have a gender bias; developed free online courses to support teachers reduce gender bias and organised meetings with Teacher-training schools to include a gender perspective.

*[Limitations]* These policies come with a government (2014-2018) that had the aim of adopting a gender perspective in education. It is uncertain if the new government will maintain them.

 ***Educational Sector:*** Universities such as *Universidad de Chile* and *Alberto Hurtado* Universities have developed face-to-face courses on gender theory and education.

On the school area, we personally met with Experimental School *Manuel de Salas*, who created a Gender Unit to reduce gender bias on interactions and expectations.

*[Limitations]* The impact is high but the scale is small, as they can only work with a small proportion of teachers each year.

 ***Third Sector:*** Very few initiatives are creating workshops of gender awareness for teachers, or connecting Women in STEM as role models to school girls so they can improve their math self-efficacy.Smaller groups have also approached schools to implement women’s empowerment.

*[Limitations]* From own our experience and interviews, schools in Chile arevery intervened and it is difficult to settle dates for workshops. Principals and teachers are always very busy.

**Solutions to overcome gender Inequality in Higher Education and Math Results**

 ***Government:*** The Gender Equity Office from the Ministry of Education (2015) has developed a special unit to conduct a gender-sensitive analysis of educational results and carry out research to find out what works to reduce disparities in math results.

 *[Limitations/Potential]* Uncertainty if new government will maintain these policies.

 ***Educational Sector:*** Universidad de Chile is one of the best universities in the country. The STEM courses have historically been male dominated. In 2014, they introduced quotas for women who are close to meet the admission test score. Academia has developed many evidence towards math gap and the link to gender stereotypes.

 *[Limitations]* These initiatives are still small; more STEM faculties could adopt quotas mechanisms for women.

**Solutions to overcome gender Inequality in STEM related jobs**

***Private Sector and Government:*** Partnerships to implement workshops from STEM companies to young students. For example, ALMA astronomic observatory hosted a workshop on gender equality with women engineers to motivate them. This was inaugurated by the Ministry of Women. Some STEM private companies have subscribed to conventions in order to improve female participation and gender equality.

***Third Sector and Private Sector:*** Initiatives such as *Laboratoria* are connecting outstanding women in STEM areas, to connect them with tech companies.

1. **LESSONS AND GAPS**

When change is about culture, norms and values, Government and Educational sector need to find consensus to implement policies. They could create dialogue and partnerships with the Private and the Third Sector as they usually tend to act more quickly. Third Sector tends to answer but in a smaller scope since it has less resources, but adapting to needs and proposing ideas in a faster paced manner. Private sector has more resources but needs to visualize the economic consequence in including more women STEM. On the other hand, Third Sector should also consider to produce knowledge. It will help them improve their ideas for problem and solution and to feed public policy.

Our analysis shows the following gaps for social innovation. There is room to make changes in one or more levels of the problem. Solution landscape actors could impact one or more levels, and consider partnerships and dialogue between them to be more effective.

* **Lack of partnerships and dialogue** between actors at different levels of the problem, especially with the **Private Sector**.
* **Lack of initiatives working on gender stereotypes reproduction:** These are a simplification of the mind, reproducing unconsciously. Search for ways to generate **gender stereotype awareness on different levels**, especially schools (teachers, principals, students) and households (parents, children).
* **Lack of knowledge creation** and sharing by all initiatives. Understand if their initiatives work or not and why.
* **Lack of connection between research and action,** for example Government could provide funding for evidence-based initiatives so the Third Sector could work on STEM gender equality.
* **Few national campaigns** to change sociocultural mind-set on gender stereotypes in relation to STEM and girls. All the actors can think of ways to contribute on this gap.

The following frame shows levers of change for the gaps, combining levels of the problem and collaboration possibilities between solution actors.

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| **Levers of Change: A possible combination** |
| **LEVELS OF THE PROBLEM / ACTORS FROM SOLUTION LANDSCAPE** | GOVERNMENT | EDUCATIONAL SECTOR | THIRD SECTOR | PRIVATE SECTOR |
| INDIVIDUAL AND HOUSEHOLD | National campaigns to change gender sociocultural mind-sets.Workshops with parents and teachers to rethink expectations and gender bias on STEM-subjects | Work with parents to eradicate gender stereotypes. Example: Short videos, children’s books where girls are into science and math, science camps and clubs for girls. | Rethink advertising that presents gender stereotypes |
| SCHOOL | Work with teachers to work on interactions, expectations and gender bias to enhance girls performance on math. | Create networks of mentoring between students and STEM undergraduates | Teacher Training with gender perspective for school teachers and undergraduates preparing to be teachers, with concrete tools, adapting to the tight schedules of teachers.  | Partnerships to fund initiatives related to girls in STEM |
| HIGHER EDUCATION | Evaluate new mechanisms for STEM courses admissions. More universities could apply quotas for women in STEM courses. | Create networks of mentoring between graduates and women in science | Connect with outstanding graduate women from STEM courses.Improve recruitment mechanisms and consider quotas.  |
| LABOUR MARKET | Legal frameworks to improve family and work conciliation | Coordinate networking events as technology and STEM fairs |
|  | **All solution actors for all levels of the problem: Partnerships and funding; knowledge creation and sharing on how to improve lack of gender diversity in STEM careers.** |
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1. Some international initiatives are included in the references documents to check what is out there trying to mitigate the gender disparities on different layers of our society. [↑](#footnote-ref-1)
2. PSU is *Prueba de Selección Universitaria* or University Selection Test. Main mechanism for university admission. Tests available are math, language, sciences and history. [↑](#footnote-ref-2)
3. Obtained in certain samples and geographic areas. For details, full list of articles available in References/Literature document. [↑](#footnote-ref-3)